DOCUMENT RESUME

ED 061 669	40	EC 041 711

AUTHOR	Semmel, Melvyn I.; And Others
TITLE	Center for Research on Language and Language Behavior. Final Report.
INSTITUTION	Michigan Univ., Ann Arbor. Center for Research on Language and Language Behavior.
SPONS AGENCY	Bureau of Education for the Handicapped (DHEW/OE), Washington, D.C.
PUB DATE	Mar 72
GRANT	OEG-0-9-322143-4236(032)
NOTE	152p.
EDRS PRICE	MF-$0.65 HC-$6.58
DESCRIPTORS	Associative Learning; Computer Assisted Instruction; Inservice Teacher Education; *Language Ability; *Language Research; *Mentally Handicapped; *Research Projects; Sensory Integration

ABSTRACT

The report presents results of both basic and applied research conducted at the Center for Research on Language and Language Behavior. Research was interdisciplinary and oriented toward the goal of contributing to the more effective learning, teaching, and use of language by persons of all ages and abilities. Studies described concerned oral word association norms for educable mentally retarded (EMR) children, relationship of paradigmatic free word associations to paired associate learning by EMRs, comprehension and imitation of sentences by mongoloid children as a function of transformational complexity, literature review of auditory integration and study of central auditory integration abilities of normal and retarded children, computer-assisted teacher training, connotative meaning of disability labels, and influence of disability labels and dialect differences on semantic differential responses of college students. (KW)

OE-BEH

ED 061669

FINAL REPORT

Project No. 322143

Grant No. OEG-0-9-322143-4236 (032)

Project Director
Harlan L. Lane, Ph.D., Director
Center for Research on Language
And Language Behavior
The University of Michigan

Transmitted by

Lee D. Beatty
Lee D. Beatty
Senior Project Representative
Office of Research Administration
The University of Michigan
Ann Arbor, Michigan 48105

Project Entitled

CENTER FOR RESEARCH ON LANGUAGE AND LANGUAGE BEHAVIOR

March 1972

Sponsored
by

U.S. Department of Health, Education, and Welfare

Office of Education

Bureau of Education for the Handicapped

EC 041 711E

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

FINAL REPORT

Project No. 322143

Grant No. OEG-0-9-322143-4236 (032)

Report Entitled

CENTER FOR RESEARCH ON LANGUAGE AND LANGUAGE BEHAVIOR

Project Director
Harlan L. Lane, Ph.D., Director
Center for Research on Language and Language Behavior
The University of Michigan
Ann Arbor, Michigan 48104

March 1972

The research reported herein was performed pursuant to a grant with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgement in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

Sponsored by

U.S. Department of Health, Education, and Welfare

Office of Education

Bureau of Education for the Handicapped

INTRODUCTION

From its conception, the goal that the Center for Research on Language and Language Behavior (CRLLB) set for itself has been to contribute to the more effective learning, teaching, and use of language by persons of all ages and abilities. To this end, the Center has carried out basic and applied research of an interdisciplinary nature, as well as programs designed to disseminate information.

A fundamental assumption in the Center's endeavors is that applied research is facilitated by an understanding of those processes that underlie all language behavior, and that a basic research on these processes should be carried out in the same environment as the applied research. The former assures the most general understanding of applied problems, while the latter makes available to those performing applied research the opportunity of consultation with basic researchers who have a commitment to considering the implications of their work for problems of language learning and language disability.

In the following chapters, an attempt is made to present the results obtained from both basic and applied research that has been undertaken by the Center under the sponsorship of the Bureau of Education for the Handicapped, U.S. Office of Education.

Chapter VIII 135

The Influence of Disability Labels and Dialect Differences on the Semantic Differential Responses of College Students

CONTENTS

Chapter I 1

Oral Word Association Norms for Educable Mentally Retarded Children

Chapter II 13

The Relationship of Paradigmatic Free-Word Associations to Paired-Associate Learning by Educable Mentally Retarded Children

Chapter III 28

Comprehension and Imitation of Sentences by Mongoloid Children as a Function of Transformational Complexity

Chapter IV 42

The Brain as Mixer, I. A Preliminary Literature Review: Auditory Integration

Chapter V 53

The Brain as Mixer, II. A Pilot Study of Central Auditory Integration Abilities of Normal and Retarded Children

Chapter VI 66

A Computer-Assisted Teacher Training System

Chapter VII 125

Connotative Meaning of Disability Labels Under Standard and Ambiguous Test Conditions

Chapter I

ORAL WORD ASSOCIATION NORMS FOR EDUCABLE MENTALLY RETARDED CHILDREN

Melvyn I. Semmel, Merrill C. Sitko, and Dorothy Semmel

Center for Research on Language and Language Behavior
The University of Michigan

100 educable mentally retarded boys gave oral word-association responses to 25 words of the Mein and O'Connor (1960) list of words most commonly used by retarded children. The responses were tabulated to provide word-association norms for this subject population.

Several investigators (Brown & Berko, 1960; Erwin, 1961; Entwisle, Forsythe & Muuse, 1964; Wicklund, Palermo, & Jenkins, 1965; Semmel, Barritt, & Bennett, 1968) have employed word-association (W-A) norms in the study of children's language and language behavior in a variety of experimental contexts. A study of children's W-A's may lead to an understanding of language processing abilities of both normal and retarded children (Semmel, 1967). W-A studies have typically employed association norms based on the responses of normal children of various ages (e.g., Palermo & Jenkins, 1964; 1966). Relatively little normative data have been collected from retarded children (Gerjuoy & Gerjuoy, 1965; Horan, 1956).

The purpose of the present study was to collect extensive word-association norms from a population of educable mentally retarded (EMR) boys.

Method

Subjects. One hundred EMR boys from the population of Wayne County Child Development Center, Northville, Michigan, were randomly selected for the study. Ss ranged in CA from 11 to 16 years with MA's from 7.0 to 11.5 yrs.

Stimulus Words. The stimulus list was constructed of 25 high frequency noun stimuli randomly selected from the Mein and O'Connor (1960) list of words most commonly used by retarded children. The list of stimulus words is presented in Table 1.

Insert Table 1 about here

Procedure. The Ss were individually tested on the 25 high-frequency noun W-A stimuli. Stimuli were typed on 5" x 8" unlined index cards. The 25 cards were randomized by hand-shuffling prior to presentation to the S. Each S was introduced to the W-A task as follows:

> We are going to play some word games today. Now, if you're ready, I'll tell you the rules for the game
>
> In this game, I will read you a word from each of these cards. The idea of the game is for you to say the first word you think of when I say the word to you. You should say just one word and not more than one.

Ss were presented two sample stimuli in order to test their understanding of the task.

Results

The responses of the 100 Ss to the 25 stimulus words were tabulated and are presented in full in the following pages. The stimuli are listed in alphabetical order, and following each stimulus are the responses and their corresponding frequencies. The last figure in each response distribution denoted by "No Response" indicates the number of Ss who failed to respond. To obtain transitional probabilities for any stimulus-response pair, divide the frequency (f) of the response by N = 100.

References

Brown, R., & Berko, J. Word-association and the acquisition of grammar. *Child Development*, 1960, *31*, 1-14.

Entwisle, F., Forsythe, D., & Muuse, R. The syntagmatic-paradigmatic shift in children's word-association. *Journal of Verbal Learning and Verbal Behavior*, 1964, *3*, 19-29.

Erwin, S. Changes with age in the verbal determinants of word-association. *American Journal of Psychology*, 1961, *74*, 361-372.

Gerjuoy, I. R., & Gerjuoy, H. Preliminary word-association norms for institutionalized adolescent retardates. *Psychonomic Science*, 1965, *2*, 91-92.

Horan, E. Word-association frequency tables of mentally retarded children. *Journal of Consulting Psychology*, 1956, *20*, 22.

Mein, R., & O'Connor, N. A study of the oral vocabularies of severely subnormal patients. *Journal of Mental Deficiency Research*, 1960, *4*, 130-143.

Palermo, D. S., & Jenkins, J. J. *Word-association norms, grade school through college*. Minneapolis: University of Minnesota Press, 1963.

Palermo, D. S., & Jenkins, J. J. Oral word association norms for children in grades one through four. University Park, Pennsylvania: Department of Psychology, 1966.

Semmel, M. I. Language behavior of mentally retarded and culturally disadvantaged children. In J. F. Magory, and R. B. McIntyre (Eds.), *Fifth Annual Distinguished Lectures in Special Education*, Los Angeles: University of Southern California Press, 1967; pp. 31-47.

Semmel, M. I., Barritt, L. S., Bennett, S. W., & Perfetti, C. A. A grammatical analysis of word-associations of educable mentally retarded and normal children. *American Journal of Mental Deficiency*, 1968, *72*, 567-576.

Wicklund, D. A., Palermo, D. S., & Jenkins, J. J. Associative clustering in the recall of children as a function of verbal association strength. *Journal of Experimental Child Psychology*, 1965, *2*, 58-66.

Table 1

Stimulus Words Used In Free Word-Association Task

apple
ball
balloon
bird
boat
clock
coat
cow
elephant
flower
fork
hand
horse
knife
man
milk
money
mother
toy
train
tree
pictures
snow
school
water

APPLE	f
eat	29
tree	10
orange	8
pie	6
red	5
peach	5
core	3
food	3
fruit	3
ate	2
good	2
pear	2
seed	2
ball	1
bite	1
box	1
good	1
jacks	1
little	1
nipple	1
plane	1
rotten	1
salt	1
teeth	1
tomato	1
worm	1
no response	7

BALL	f
bat	19
play	18
baseball	8
bounce	3
catch	3
rubber	3
throw	3
apple	2
blue	2
fall(ing)	2
Football	2
game	2
hard	2
toy	2
air	1
alley	1
bell	1
bull	1
cup	1
dodge	1
doll	1
foot	1
glove	1
green	1
guinea pig	1
hall	1
hit	1
kill	1
net	1
orange	1
picked	1
saw	1
small	1
stable	1
superball	1
water	1
no response	7

BALLOON	f
air	16
blow	16
bust(ed)	8
ball	7
float	7
string	7
play	4
fly	3
red	3
airplane	2
big	2
circus	2
wind	2
baby	1
bag	1
basket	1
box	1
broom	1
fun	1
high	1
have	1
party	1
plastic	1
pop	1
pretty	1
man	1
rubber	1
toy	1
wall	1
no response	5

BIRD	f
fly	23
nest	16
tree	10
baby	4
feather	4
house	4
animal	3
beak	2
cat	2
eagle	2
plane	2
robin	2
bat	1
bee	1
big	1
blue	1
blue bird	1
blue jay	1
cage	1
egg	1
feet	1
geese	1
girl	1
nature	1
monkey	1
mother robin	1
pidgeon	1
saw	1
whistle	1
wings	1
woody woodpecker	1
no response	7

BOAT	f
sail(ing)	13
water	13
ride(s)	9
canoe	5
river	5
ship	5
fish(ing)	4
float(s)	4
motor	4
house	3
paddle	3
airplane	2
car	2
lake	2
shoe	2
bat	1
bathtub	1
beet	1
big	1
birds	1
boatride	1
broom	1
coat	1
fast	1
glasses	1
moat	1
ocean	1
new	1
people	1
racing	1
row	1
sea	1
skiing	1
steam	1
toy	1
no response	4

CLOCK	f
time	47
watch	12
tick	6
wall	4
hands	3
lock	3
bell	2
click	2
numbers	2
bird	1
circle	1
cluck	1
dial	1
fast	1
got	1
knock	1
minute	1
moves	1
new	1
sound	1
ten	1
tock	1
twelve	1
no response	5

COAT	f
wear	23
hat	13
warm	11
jacket	8
sweater	5
boat	4
hanger	4
new	4
button	3
rack	3
cold	2
cap	1
cloth	1
clothing	1
got	1
hang	1
material	1
nice	1
old	1
overcoat	1
person	1
pocket	1
store	1
zipper	1
no response	7

COW	f
milk	49
calf	10
horse	6
animal	5
pig	3
baby	2
farm	2
moo	2
sheep	2
barn	1
big	1
brown	1
cap	1
cook	1
farm	1
fat	1
feed	1
field	1
grass	1
hand	1
how	1
lion	1
ranch	1
see	1
sow	1
no response	3

ELEPHANT	f
animal	12
baby	10
giraffe	8
trunk	7
jungle	6
big	5
horse	5
bear	3
circus	3
fat	3
lion	3
tiger	3
zoo	3
adventure	1
ant	1
cage	1
drums	1
ears	1
excite	1
fin	1
giant	1
great	1
heavy	1
hippototamus	1
horn	1
hunt	1
kangaroo	1
large	1
monkey	1
mouth	1
parade	1
peanuts	1
pet	1
stand	1
strong	1
tail	1
trumpet	1
tusk	1
no response	4

FLOWER	f
plant	14
pot	11
garden	7
smell	6
grow(s)	5
pretty	5
rose(s)	5
daisy	3
tree	3
bloom	2
dirt	2
rain	2
seeds	2
sun(ny)	2
bed	2
tulip	2
anniversary	1
beautiful	1
bees	1
bowl	1
box	1
bright	1
cake	1
died	1
door	1
fruit	1
ground	1
insects	1
had	1
keep	1
mother	1
nice	1
real	1
roots	1
show	1
shower	1
spring	1
stem	1
water	1
no response	4

FORK	f
eat	30
spoon	26
knife	23
bent	1
cork	1
food	1
foot	1
fowl	1
handle	1
help	1
metal	1
one	1
ouch	1
peck	1
rope	1
silverware	1
sharp	1
use	1
no response	6

HAND	f
finger	22
arm	12
feet	4
work	4
band	3
glove	3
man	3
wash	3
body	2
handle	2
hat	2
palm	2
pencil	2
use	2
write	2
broke	1
candy	1
carry	1
cut	1
face	1
feel	1
fist	1
friend	1
good	1
grab	1
ham	1
handing	1
head	1
hold	1
knuckles	1
leg	1
plane	1
pig	1
skin	1
shake	1
slap	1
small	1
smooth	1
thumb	1
towel	1
wiggle	1
no response	6

HORSE	f
ride	27
saddle	8
pony	8
animal	5
baby	4
cow	4
donkey	4
hay	4
barn	3
house	3
stable	3
colt	2
big	1
boy	1
farm	1
gallop	1
hair	1
head	1
met	1
morse	1
mouse	1
mule	1
noise	1
play	1
race	1
red	1
shoe	1
strong	1
tail	1
toy	1
wagon	1
yard	1
no response	5

KNIFE	f
fork	25
cut	16
sharp	8
blade	5
gun	3
jack(knife)	3
spoon	3
butter	2
butterknife	2
case	2
kill	2
silverware	2
butcher	1
cake	1
carve	1
cup	1
equipment	1
fife	1
fight	1
fine	1
hamburger	1
hand	1
holder	1
holster	1
man	1
meat	1
pocket	1
point	1
silver	1
stab	1
sword	1
use	1
no response	7

MAN	f
woman	23
boy	8
father	7
lady	6
men	5
hat	3
work	3
big	2
can	2
girl	2
hand	2
person	2
am	1
any	1
batman	1
dad	1
daddy	1
feet	1
finger	1
gentlemen	1
grow	1
grown-up	1
house	1
humanbeing	1
kids	1
manhole	1
man's	1
mrs.	1
mother	1
nice	1
parents	1
postman	1
sad	1
store	1
strong	1
son	1
suit	1
talk	1
tau	1
no response	8

MILK	f
drink	27
cow	24
glass	8
bottle	6
man	6
water	5
cat	2
cocoa	2
cake	1
calf	1
cereal	1
chocolate	1
cup	1
farm	1
good	1
liquid	1
milkman	1
trucks	1
white	1
no response	9

MONEY	f
spend(ing)	20
dollars	14
monkey	5
bank	4
pocket	4
wallet	4
buy	3
gold	3
cash	2
change	2
dough	2
honey	2
penny	2
pay	2
bag	1
candy	1
car	1
cheer	1
clothes	1
cents	1
food	1
got	1
kind	1
lots	1
many	1
metal	1
nickel	1
paper	1
people	1
pocketbook	1
purse	1
play	1
quarter	1
rich	1
silver	1
some	1
store	1
twenty-five cents	1
no response	6

MOTHER	f
father	56
mom	7
grand(mother)	3
child	2
lady	2
love	2
nice	2
parent(s)	2
woman	2
baby	1
children	1
dad	1
family	1
friend	1
good	1
help	1
home	1
kind	1
men	1
mouse	1
my	1
nature	1
pretty	1
wife	1
works	1
no response	6

TOY	f
play	45
boy	8
car	6
box	4
gun	4
boat(s)	3
games	3
ball	2
top	2
baby	1
bike	1
broke	1
candy	1
children	1
drums	1
duck	1
house	1
my	1
paper	1
plane	1
present	1
radio	1
train	1
truck	1
no response	8

TRAIN	f
tracks	25
ride(s)	18
car	11
go	5
caboose	3
fast	3
engineer	2
plane	2
run(s)	2
animals	1
big	1
bus	1
carry	1
"choochoo"	1
chug	1
city	1
dog	1
engine	1
electric	1
hay	1
horn	1
house	1
locomotive	1
man	1
passengers	1
places	1
rails	1
set	1
toy	1
tractor	1
wheels	1
work	1
no response	6

TREE	f
leaves	16
apple(s)	9
house	7
climb	6
branch(es)	5
leaf	5
plant	5
flower	4
green	4
birds	3
trunk	3
bee	2
big	2
grass	2
grow(s)	2
nest	2
bark	1
brown	1
breeze	1
eat	1
falls	1
grounds	1
insects	1
knee	1
limb	1
mouse	1
nature	1
play	1
pretty	1
seed	1
stump	1
top	1
wood	1
no response	6

PICTURES	f	SNOW	f	SCHOOL	f
frame	13	rain	11	learn	24
look	11	cold	9	work	17
paint(ing)	10	ball	8	room	6
camera	8	ice	7	boy(s)	4
hang(ing)	5	winter	7	building	4
pretty	5	snowball	6	house	4
draw(ing)	4	white	5	children	4
people	4	play	5	church	3
color	3	man	4	teacher	3
wall	3	shovel	4	bus	2
book(s)	2	sled	3	arithmetic	1
develop	2	blow	2	big	1
man	2	fall	2	build	1
movie(s)	2	flake(s)	2	class	1
nice	2	grass	2	college	1
paper	2	ground	2	door	1
show	2	outside	2	fire	1
art	1	summer	2	good	1
bear	1	weather	2	help	1
film	1	blizzard	1	home	1
gloves	1	boy	1	in	1
good	1	clouds	1	junkyard	1
got	1	hard	1	like	1
make	1	melt	1	new	1
person	1	out	1	office	1
school	1	sleigh	1	play	1
see	1	snowman	1	place	1
snap	1	sun	1	pool	1
"tooken"	1	throw	1	spool	1
t.v.	1	water	1	spoon	1
no response	7	no response	4	toy	1
				yard	1
				no response	7

WATER	f
drink	34
swim(ming)	7
glass	6
milk	6
boat	3
river	3
sea	3
blue	2
fountain	2
ice	2
koolaid	2
liquid	2
well	2
wet	2
bath	1
boy	1
door	1
faucet	1
fish	1
good	1
lake	1
lot(of)	1
man	1
melon	1
mud	1
ocean	1
pipe	1
pitcher	1
plant	1
pop	1
pool	1
snow	1
tank	1
tower	1
no response	4

Chapter II

THE RELATIONSHIP OF PARADIGMATIC FREE-WORD ASSOCIATIONS TO PAIRED-ASSOCIATE LEARNING BY EDUCABLE MENTALLY RETARDED CHILDREN

Melvyn I. Semmel, Merrill C. Sitko, and Dorothy Semmel

Center for Research on Language and Language Behavior

The University of Michigan

The relationship of paradigmatic free word associations (W-A) to paired-associate (P-A) learning was investigated in 72 educable mentally retarded boys. Ss were grouped into high and low paradigmatic responders to a free W-A task. The two groups were each randomly divided into four subgroups and assigned one of four P-A lists which differed in the degree of associative strength and in the grammatical form class of their items. P-A performance of low paradigmatic Ss was inferior to that of high paradigmatic Ss when associative strength between P-As was low. The effect was greatest when the stimulus items were low-associative paradigmatic nouns. Performance of the two groups did not differ when associative strength between stimulus items was high, regardless of the form-class relationship of word pairs.

Several investigators (Brown & Berko, 1960; Erwin, 1961; Entwisle, Forsythe & Muuse, 1964) have demonstrated a relationship between chronological age and grammatical form-class of free-associative responses in word association (W-A) tasks. As children grow older, they tend to show a developmental shift from sequential responses (syntagmatic responses) to associations falling within the same grammatical form-class as the stimulus (paradigmatic responses). The shift from syntagmatic to paradigmatic word associations is suggested as evidence for an increasing grammatical development in the language functioning of children (Brown & Berko, 1960).

Semmel, Barritt, Bennett and Perfetti (1966) used a W-A task to compare normal and educable mentally retarded children (EMR) on paradigmatic and syntagmatic responses. The results introduced intellectual level as a significant variable associated with the probability of emitting paradigmatic associates. Retarded children gave fewer responses in the same form-class than did normal children of equal chronological age. The results were interpreted as revealing a deficit among EMR children characterized by a weakness in organizing linguistic units into classes. A later study by the same authors (1967) comparing the performance of EMR and normal children on a modified Cloze task provided support for the hypothesis that EMR children have weak grammatical decoding habits, and are primarily dependent on sequential cues in decoding language.

Semmel (1967) has suggested that the EMRs' deficit reflects their relatively greater dependence on simple associative relationships between linguistic units than on structural syntactic cues. He argues that sequential strategies in processing sentences are probably characteristic of retarded children. A recent short-term memory study by Semmel and Bennett (1968) supported the hypothesis that EMR children demonstrate inefficient organizational strategies in processing linguistic strings: EMRs demonstrated relatively weak recoding abilities and took relatively little advantage of the structural cues inherent in the verbal material processed.

According to Semmel and his associates the language behavior of EMR children does not necessarily reflect deficient grammatical competence. Rather, the generative rules which the EMR children obviously use in encoding sentences do not appear to be so efficiently evoked in their decoding and recoding performance when compared to that of normal children of the same or lower CA. In fact, a recent preliminary study (Semmel, Lifson & Sitko, 1967) indicated that EMR children might be trained to increase the frequency of high associate paradigmatic responses on a multiple-choice word association task immediately after training. Ss were able to maintain the new performance for a week after training. These results, if confirmed, would imply that the relatively low incidence of paradigmatic word associations among EMR children may not be indicative of an immutable lag in the development of linguistic competence. Rather, retarded children, like normal children of equal CA, probably have the competence to store linguistic units into appropriate classes, but whereas normal children tend to utilize such strategies "naturally," EMRs do not.

Although EMR children as a group have the tendency to emit syntagmatic associates on a W-A task, previous results indicated significant individual differences within the retarded group. If W-A responses are indicative of "language strategies" adopted by Ss, then it appeared reasonable to expect that such responses would be related to P-A learning. It also appeared plausible that P-A learning would be a function of the interaction of grammatical and associative relationships between P-A word stimuli and the mediational strategies used by Ss. The present study undertook to test these predictions by examining the P-A learning performance of EMR boys who showed themselves, in a free W-A test, as predominantly either paradigmatic or syntagmatic.

Method

Subjects

Seventy-two EMR boys from the population of Wayne County Child Development Center, Northville, Michigan, were randomly selected for the study. Ss ranged in CA from 10 to 16 years with MAs from 6 to 11 years. Table 1 presents the characteristics of the eight subgroups of Ss used in this study.

Insert Table 1 About Here

Stimulus Words

In order to divide the Ss into a high and a low paradigmatic group, a pretest was constructed with 25 high frequency noun stimuli selected from the Mein & O'Connor (1960) list of words most commonly used by retarded children. Nouns were selected as stimuli for the pretest since noun stimuli should have the highest probability of eliciting paradigmatic responses from EMR children (Semmel et al., 1966).

Insert Table 2 About Here

Four word-lists of eight P-As each were used as stimuli for the learning task. The items were selected from standard primer and pre-primer basal readers and also appeared on the Jenkins and Palermo (1963) word association norms. The eight P-A items of each list were composed of a stimulus noun element and a response noun, verb or adjective. In list H-P the response items were high-associative paradigmatic nouns as indicated by the Jenkins and Palermo norms. In list L-P the response items were low-associative paradigmatic nouns, i.e., nouns that did not appear on the norms. In list H-S the response items were either high-associative verbs or adjectives (syntagmatic) which appeared on the norms. In list L-S the response items were either low-associative verbs or adjectives (syntagmatic). Intra-list association was controlled -- only stimuli with low intra-list association on the norm list were selected. The criterion for inclusion was 5% or less association between all possible pairs of secondary stimuli.

Insert Table 3 About Here

Procedure

The *S*s were individually pretested on the 25 high-frequency noun W-A stimuli. Words were randomized by hand-shuffling prior to presentation to the *S*s. These were the instructions:

> We are going to play some word games today. Now, if you are ready, I will tell you the rules for the game. In this game, I will read you a word from each of these cards. The idea of the game is for you to say the first word you think of when I say the word to you. You should say just one word and not more than one.

*S*s were presented two sample stimuli in order to test understanding of the task.

Coding Procedures

*S*s' W-A responses on the pretest were recorded so as to provide a baseline of paradigmatic and syntagmatic responses. Free W-A responses were coded by two judges according to the procedure employed by Semmel et al.(1966). *S*s were then divided into two groups, a high-paradigmatic group consisting of those *S*s who scored above the median on the pretest for the total sample, and a low-paradigmatic group consisting of those *S*s who scored below the median. Table 4 presents the mean percentage of paradigmatic responses on the 20-word free W-A pretest and *SDs* for high- and low-paradigmatic *S*s. A *t* test for independent samples indicated a significant difference between the percentage of paradigmatic associations (t=14.63/df=70/p < .01).

Insert Table 4 About Here

Experimental Design

Prior to the learning phase of the experiment, *S*s were presented with the 8 stimulus words and 8 randomly chosen response words from the four word-lists to ensure that the words were within their sight vocabulary. *S*s who failed to read all 16 words after three trials were thanked for their assistance and sent back to their room. Of the 80 *S*s tested, 72 passed the pretest. Free W-A scores were used to stratify the experimental groups. The 36 high-paradigmatic *S*s and the 36 low-paradigmatic *S*s were randomly cast into four subgroups each. The four lists were randomly assigned to these subgroups.

Ss were tested individually in a quiet school room. Following the pretest, the Ss were introduced to the learning task with the following words:

> Now we are going to play a word game with these cards, and I want you to do your best. I want you to say the name of this word as I show it to you and look at the word that goes along with it. Try to remember that this word goes along with this word because later I am going to show you just the word and ask you to tell me which word goes with it. First, let's look at the words so you can see which ones go together. Then we will play the game.

E then manually presented each card to S at a rate of 5 sec. per card. S pronounced the name of each word. After one trial through the list, S was reminded:

> Now remember, I am going to show you only the word and you must tell me the word that goes with it.

The cards were then presented at the same rate (one per 5 sec.) with a 20-sec. intertrial interval. Stimuli were printed by hand in large block letters on 5 x 8 in. unlined index cards. After each trial the 8 cards for each list were hand shuffled in an effort to prevent serial effects. Learning was by the anticipation method throughout. For each of the eight subgroups, a criterion of three perfect trials of eight correct anticipations was used.

Results

The P-A data were analyzed through a 2x2x2 fixed ANOVA design. Trials to criterion served as the dependent variable. The effects of paradigmatic subgroup classification, form-class of stimuli and associative strength of P-A stimuli were assessed. Table 5 presents the summary of this analysis.

Insert Table 5 About Here

The main effects of subgroup classification (high vs low paradigmatic subgroups) and degree of associative strength of word pairs were significant ($p < .01$) The interaction of subgroup classification with associative strength of P-A stimuli was also statistically significant ($p < .05$). Table 6 presents mean trials to criterion and SDs of associates correctly anticipated by the eight subgroups.

Insert Table 6 About Here

Figure 1 indicates the nature of the significant AC interaction (see Table 5). The superiority in P-A learning of high-paradigmatic *S*s was significant when stimulus pairs were low-associative, as in lists L-P and L-S. This effect appears again in Figure 2, which shows mean trials to criterion for both subgroups across the four lists. However, the Tukey procedure (Winer, 1962) for within groups revealed that only on the L-P list, where associative strength among P-As was low, was learning superior in high paradigmatic *S*s ($p < .01$). On the L-S list, where the associative strength among P-As was also low, learning by the two subgroups did not differ significantly, nor did it when the P-As were high associative, as in lists H-P and H-S.

Insert Figure 1 and Figure 2 About Here

Tukey analysis also revealed that mean criterion scores for the high paradigmatic *S*s did not differ significantly across the four lists. For low paradigmatic *S*s, mean criterion scores on lists H-P and H-S were significantly lower ($p < .01$; $p < .05$) than the mean criterion scores obtained by low-paradigmatic *S*s on lists L-P and L-S (where associative strength between word pairs was relatively low).

The main effect of degree of grammaticalness among paired-associates was not significant and did not interact with the other two main factors.

The correlations between paradigmatic responses and the three subject variables (CA, Verbal IQ, Full Scale IQ (for the total subject population) were respectively: $r_{CA} = .01$ ($p > .05$), $r_{VIQ} = .15$ ($p > .05$), $r_{FSIQ} = .30$ ($p < .05$). The correlations between the dependent measure (trials to criterion) and the subject variables were $r_{CA} = .09$, $r_{VIQ} = .25$, $r_{FSIQ} = .17$. All three correlations were nonsignificant ($p > .05$). Nor was there any significant correlation ($r = -.22$, $p > .05$) between paradigmatic responses and the criterion measure.

Discussion

The results of the free W-A pretest provided further support for the contention (Semmel et al., 1967) that EMR children are not predominantly paradigmatic responders on free word-association tasks. The paired-associate data indicated that relatively low-paradigmatic EMR responders learn P-A stimuli which are linked in a strong associative relationship with greater ease than when the relation between stimulus pairs is based on grammatical form-class. Low-paradigmatic Ss performed best when the associative strength between word pairs was high, regardless of the form-class relationship (i.e. paradigmatic or syntagmatic) of word pairs. Low-paradigmatic Ss' P-A learning was inferior to that of high-paradigmatic Ss when associative strength between word pairs was low, especially when the stimulus items were low-associative, paradigmatic nouns. When associative strength between word pairs was high, the performance of low- and high-paradigmatic Ss was similar.

It appears from this study that EMR boys who are predominantly high-paradigmatic W-A responders are able to utilize both grammatical and associative cues in learning P-As. The performance of the low-paradigmatic responders on the high-paradigmatic list suggests that they, too, have the paradigmatic competence needed to recode linguistic units into grammatical form-classes; but whereas high-paradigmatic responders tend to avail themselves of this competence naturally, as their superior performance on the low-paradigmatic list bears witness, low-paradigmatic EMR subjects have no such strong habits. The high-associative pairs in lists H-P and H-S provided stronger cues than the low-associative pairs in lists L-P and L-S. When these associative cues were not available to low-paradigmatic Ss, they were relatively inefficient in organizing linguistic units into classes. Hence, low-paradigmatic responders are comparatively more dependent on simple associative cues between linguistic units than on hierarchically organized ones. As a result, their P-A learning is inferior to that of high-paradigmatic responders on lists where the association between stimulus pairs is low or based on paradigmatic criteria.

The results of the P-A study do not appear to be a function of an initial IQ difference between subjects. Although the correlation between paradigmatic responses and FSIQ was significant, about 90% of the variance remains unexplained. Furthermore, the correlations between the criterion variable and the subject variables were non-significant. It is plausible, therefore, to suggest a difference in "language strategy" between high and low-paradigmatic responders in decoding and recoding verbal stimuli.

References

Brown, R.,& Berko, J. Word association and the acquisition of grammar. Child Development, 1960, 31, 1-14.

Entwisle, F., Forsythe, D., & Muuse, R. The syntactic-paradigmatic shift in children's word-association. Journal of Verbal Learning & Verbal Behavior, 1964, 3, 19-29.

Erwin, S. Changes with age in the verbal determinants of word association. American Journal of Psychology, 1961, 74, 361-372.

Mein, R., & O'Connor, N. A study of the oral vocabularies of severely subnormal patients. Journal of Mental Deficiency Research, 1960, 4, 130-143.

Palermo, D. S., & Jenkins, J. J. Word association norms, grade school through college. Minneapolis: University of Minnesota Press, 1963.

Semmel, M. I. Language behavior of mentally retarded and culturally disadvantaged children. In J. F. Magary & R. B. McIntyre (Eds.), Fifth annual distinguished lectures in special education. Los Angeles: University of Southern California Press, 1967. Pp.31-47.

Semmel, M. I., Barritt, L. S., Bennett, S. W., & Perfetti, C. A. Grammatical form class in word associations of educable mentally retarded and normal children. Studies in language and language behavior, III, July 1, 1966, Center for Research on Language & Language Behavior, University of Michigan, Contract No. OEC-3-6-061784-0508, Office of Education.

Semmel, M. I., Barritt, L. S., Bennett, S. W., & Perfetti, C. A. The performance of educable mentally retarded and normal children on a modified Cloze task. Studies in language and language behavior, V, September 1, 1967. Center for Research on Language and Language Behavior, University of Michigan, Contract No. OEC-3-6-061784-0508, Office of Education.

Semmel, M. I., Lifson, M. W., & Sitko, M. C. Learning and transfer of paradigmatic word associations by educable mentally retarded children: a preliminary study. *Studies in language and language behavior, V*, September 1, 1967. Center for Research on Language and Language Behavior, University of Michigan, Contract No. OEC-3-6-061784-0508, Office of Education.

Semmel, M. I., & Bennett, S. E. Effects of grammatical and associative structure, delay interval, and activity during delay on memory span of educable retarded children. *Studies in language and language behavior, VI*, February 1, 1968. Center for Research on Language and Language Behavior, University of Michigan, Contract No. OEC-3-6-061784-0508, Office of Education.

Winer, B. J. *Statistical principles in experimental design*. New York: McGraw-Hill 1962.

Figure Captions

Fig. 1. Subject by associative strength interaction.

Fig. 2. Mean trials to criterion of high and low paradigmatic subjects across the four paired-associate lists.

Table 1

Characteristics of the Eight Subgroups

(N=9 each subgroup)

Variable		H-P Ss H-P List	L-P Ss H-P List	H-P Ss L-P List	L-P Ss L-P List	H-P Ss H-S List	L-P Ss H-S List	H-P Ss L-S List	L-P Ss L-S List
		SUBGROUP							
CA (Years)	Mean	14.21	13.53	12.71	14.09	12.80	13.59	13.98	13.25
	SD	1.12	1.12	1.15	1.05	1.67	0.91	1.19	1.85
	Range	12.4-15.5	11.3-15.0	11.0-14.4	13.1-15.8	10.3-15.6	12.3-15.2	12.0-16.2	10.7-16.1
WISC Verbal I.Q.	Mean	74.88	72.38	72.86	69.33	72.50	72.60	76.00	72.14
	SD	8.36	7.07	6.05	7.31	7.46	1.95	5.61	3.85
	Range	62-86	62-82	55-84	56-80	58-81	70-75	70-84	65-77
WISC Full Scale I.Q.	Mean	75.00	69.33	74.33	68.56	73.11	70.71	74.33	70.00
	SD	4.39	8.06	3.24	6.86	5.37	6.05	4.12	5.86
	Range	67-80	56-78	71-80	58-78	63-79	63-78	65-79	61-79

Subgroup Abbreviations

H-P Ss--High Paradigmatic Subject Group (N = 36)
L-P Ss--Low Paradigmatic Subject Group (N = 36)
H-P List--High Paradigmatic Paired-Associate List
L-P List--Low Paradigmatic Paired-Associate List
H-S List--High Syntagmatic Paired-Associate List
L-S List--Low Syntagmatic Paired-Associate List

Table 2

Free Word-Association Pretest

mother	school	money	train	horse
elephant	water	fork	snow	milk
knife	coat	bird	tree	apple
hand	cow	toy	clock	ball
boat	pictures	flower	ballon	man

Table 3

Paired Associate Lists

High Paradigmatic (H-P)		Low Paradigmatic (L-P)	
chair	table	chair	rug
girl	boy	girl	coat
foot	hand	foot	pants
dogs	cats	dogs	birds
sheep	wool	sheep	hill
bread	butter	bread	tea
doors	windows	doors	walls
city	town	city	snow

High Syntagmatic (H-S)		Low Syntagmatic (L-S)	
chair	sit	chair	low
girl	pretty	girl	one
foot	walk	foot	blue
dogs	bark	dogs	see
sheep	white	sheep	sit
bread	eat	bread	cook
doors	open	doors	cold
city	big	city	new

Table 4

Mean Percentage of Paradigmatic Responses and SD'S on Free Word-Association Test

	Total Subject Group (N=72)	High Paradigmatic Ss (N=36)	Low Paradigmatic Ss (N=36)
Mean %	54.93	71.95	37.90
SD	21.39	13.22	12.22
Range	5 - 100	55 - 100	5 - 55

Table 5

Summary of Analysis of Variance for the Three Factors Studied

Source	SS	df	MS	F
A (Paradigmatic Subject Classification)	51.68	1	51.68	9.10**
B (Paradigmatic vs Syntagmatic Paired-Associates)	1.68	1	1.68	0.30
C (Associative Strength of Paired-Associates)	260.68	1	260.68	45.89**
AB	15.12	1	15.12	2.66
AC	36.12	1	36.12	6.36*
BC	6.12	1	6.12	1.08
A x B x C	10.12	1	10.12	1.78
Error (within)	363.80	64	5.68	
Total	745.32	71		

* Sig. < .05 level

** Sig. < .01 level

Table 6

Mean Trials to Criterion of Paired Associates

Correctly Anticipated

Subjects		LISTS A High Paradigmatic	B Low Paradigmatic	C High Syntagmatic	D Low Syntagmatic
High Paradigmatic Subjects	$\bar{x}$	3.9	6.1	4.3	6.9
(N=32, 8 subjects per list)	SD	0.60	2.37	1.23	1.69
	Range	3-5	4-11	3-6	4-9
Low Paradigmatic Subjects	$\bar{x}$	4.3	10.9	4.4	8.3
(N=32, 8 subjects per list)	SD	1.87	4.84	1.73	1.73
	Range	3-8	6-19	3-10	6-12

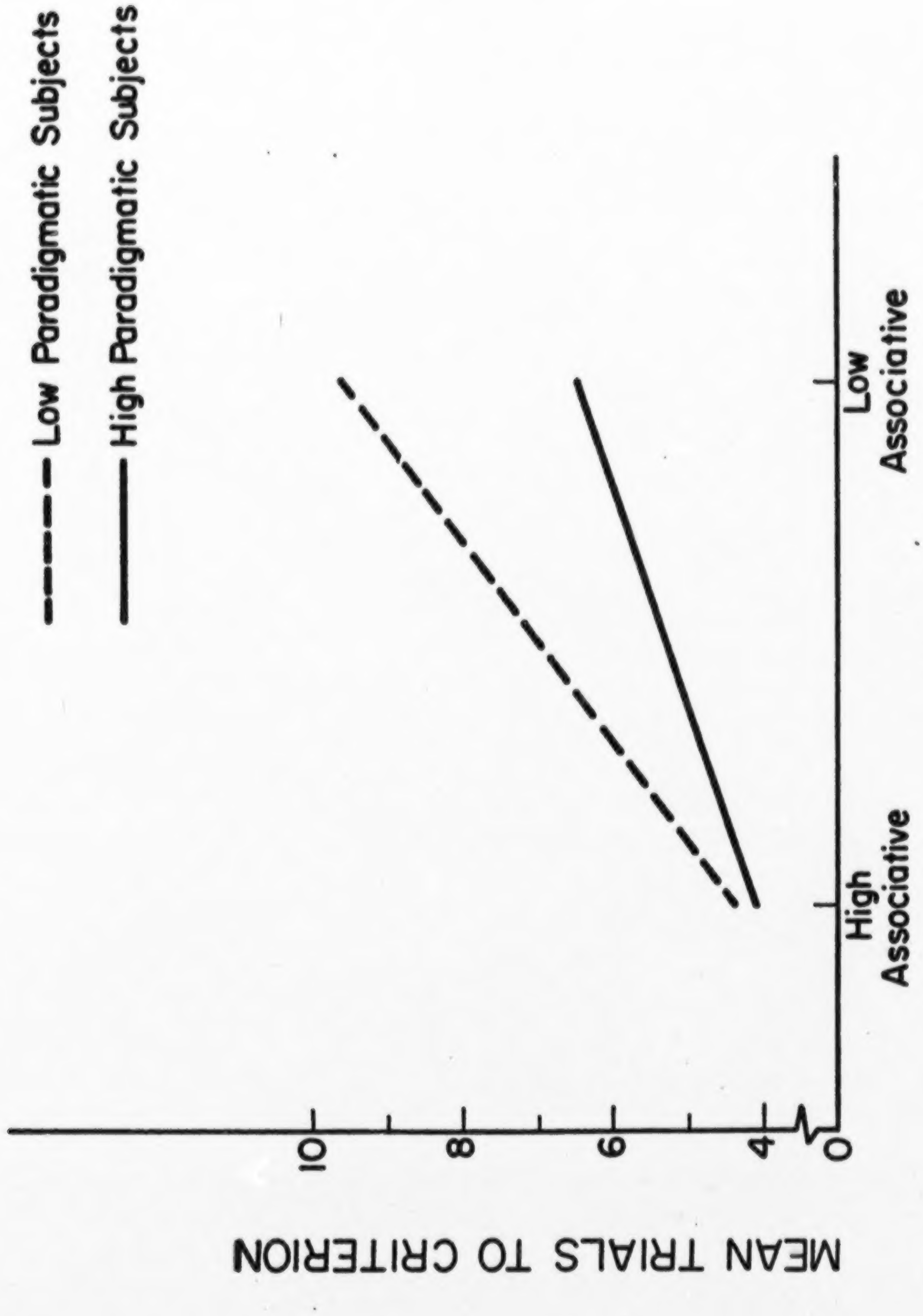

Low Paradigmatic Subjects
High Paradigmatic Subjects
MEAN TRIALS TO CRITERION
10
8
6
4
0
High Associative
Low Associative
LISTS

Figure 1

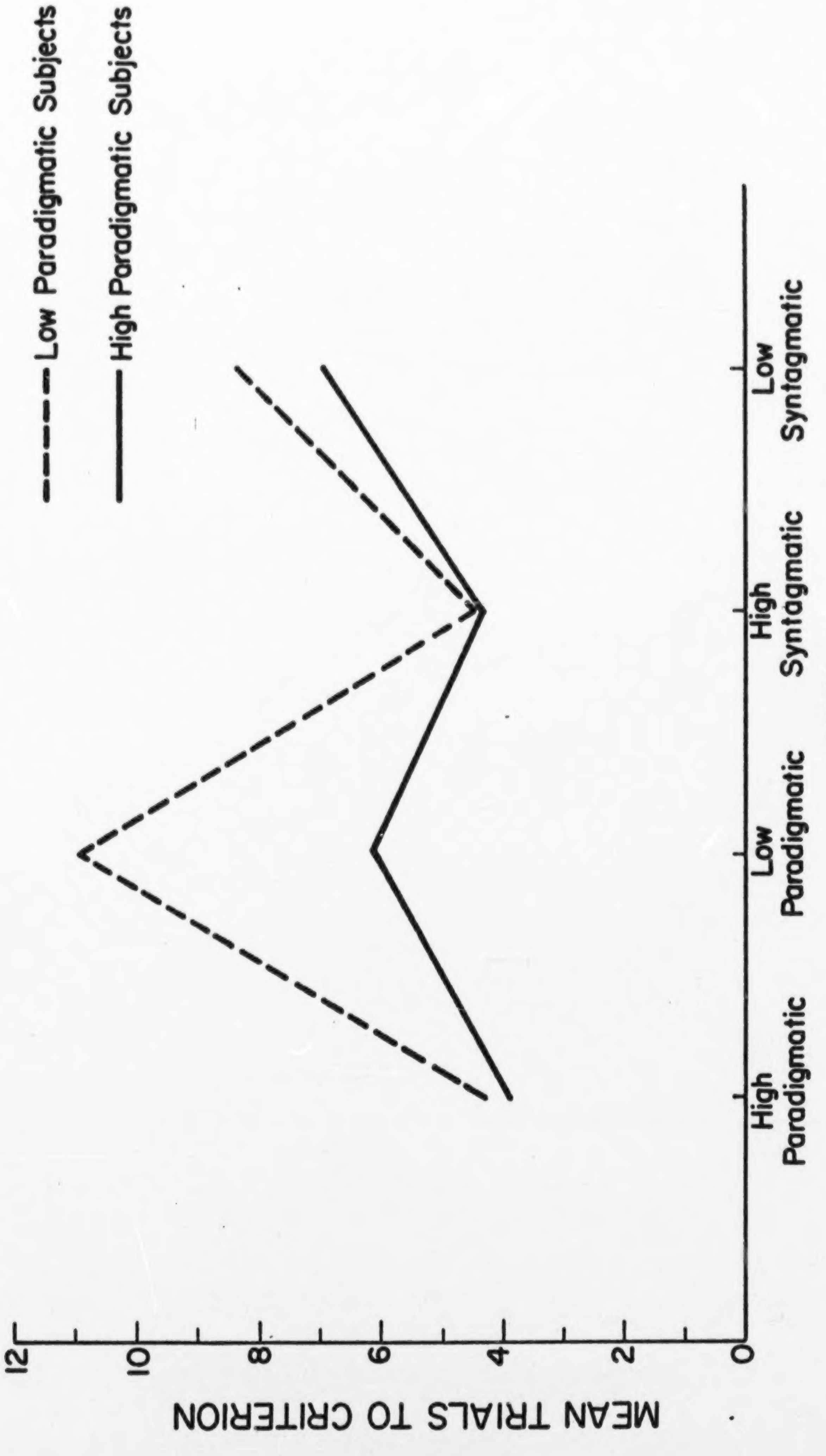

Low Paradigmatic Subjects
High Paradigmatic Subjects
MEAN TRIALS TO CRITERION
12
10
8
6
4
2
0
High Paradigmatic
Low Paradigmatic
High Syntagmatic
Low Syntagmatic
LISTS

Figure 2

Chapter III

COMPREHENSION AND IMITATION OF SENTENCES BY MONGOLOID CHILDREN AS A FUNCTION OF TRANSFORMATIONAL COMPLEXITY

Melvyn Semmel and Diane Greenough

Center For Research on Language and Language Behavior

University of Michigan

Abstract

The effect of sentence complexity on the ability of 40 trainable mentally retarded (TMR) mongoloid Ss ($\bar{X}_{IQ} = 34.3$) to comprehend and imitate verbally presented strings was examined in 2 studies. Comprehension ability was tested by asking each S to indicate which of 2 pictures was being described in the sentence spoken by E. 8 stimulus sentences were spoken by E for each pair of pictures--simple declarative or kernel (K), negative (N), passive (P), and negative passive (NP) for each picture. S's ability to imitate sentences of varying levels of complexity was tested by having him repeat the sentences used in the comprehension task, with passive forms truncated so that stimuli would be nearly equal in length. Ss correctly comprehended kernel sentences significantly more often than chance expectancy but comprehended negative sentences less often than would be expected by chance. Imitation of kernel sentences (obligatory transformations only) was significantly better than imitation of sentences in which optional transformations had been applied. No significant differences in accuracy of imitation were observed among the strings with optional transformations. Results are discussed in terms of competence and performance variables which might affect the ability of TMR Ss to deal with verbal stimuli.

The relationship of the grammatical complexity of a sentence and the speed of comprehension among adult Ss has been studied by Gough (1965;1966). Slobin (1966) has reported findings with both normal adults and children. Using a procedure in which Ss indicated the truth-value of a sentence in relation to a picture presented by E, it was found that latencies of correct responses were of the following order: kernel < passive < negative < negative passive. These results were offered as evidence that speed of comprehension is inversely proportional to the number of transformations separating a sentence from its base structure. Simple declarative (kernel) sentences result from obligatory transformations of the base structure and are thought to be the simplest sentence forms (Chomsky, 1965). Addition of the semantic element of negation apparently creates more difficulty for comprehension than do grammatical transformations. Thus, Slobin and Gough found slowest comprehension rates when the negative (semantic) transformation was applied. Slobin also reported that chronological age (CA) interacts significantly with syntactic structure--suggesting developmental changes in linguistic competence. IQ and reaction time to sentences did not correlate significantly.

The present studies were designed to test whether these findings can be extended to trainable mentally retarded (TMR) children. The investigators were also interested in developing a method for the clinical study of language comprehension of TMR children. It was hypothesized that the hierarchy of difficulty reported by Gough and Slobin for comprehension and imitation of sentences would reoccur with TMR _Ss_ and would be associated with CA but not with IQ (Lenneberg, Nichols, & Rosenberger, 1964).

Study I: Comprehension

Method

Subjects. _Ss_ were 40 mongoloid children ranging in CA from 6 to 14 years ($\bar{X}$ = 135 mos., _SD_ = 19 mos.) and enrolled in the program for the TMR in Wayne County Intermediate School District. _Ss_ were characterized by their teachers as having no gross visual, auditory, or motor impairments. There were 21 males and 19 females in the sample. Binet IQ range was 22 to 62 ($\bar{X}$ = 34.3, _SD_ = 9.6).

Procedure. Four pairs of pictures, each pair representing both aspects of a reversible situation, were used as stimuli. The pictures were brightly colored and mounted on 8 x 10" cards. The following situations were depicted: (a) Ball hitting clown, clown hitting ball, (b) Boy kicking girl, girl kicking boy, (c) Ball hitting flowers in pot, pot of flowers hitting ball, (d) Dog chasing cat, cat chasing dog.

For each pair of pictures, two kernel, i.e., declarative (K), two negative (N), two passive (P), and two negative passive (NP) sentences were presented to _S_. Order of presentation was randomized for each pair of pictures. The sentence stimuli used are presented in Table 1.

Insert Table 1 about here

Each S was tested by one of three Es in an empty classroom. After being seated at a small table across from E, S was encouraged to interact with E for approximately ten minutes so as to adapt to the experimental environment. Four pictures, one from each pair, were placed before S, who was asked to point to the one he liked best. The picture he selected determined which pair of stimuli was presented first. E then said, "See these pictures? Point to the one where..." and then gave the first sentence for that pair of pictures. Eight sentences were presented for each pair of pictures.

Responses were recorded as correct or incorrect. E also recorded the position of stimuli as they were placed before S so that position preference could be detected if present.

Results

The responses of nine Ss had to be discarded because they could not be induced to perform the task.

Analysis of responses in terms of the position of the picture selected revealed no tendency of Ss to favor a specific position or to follow a set pattern of responses.

Figure 1 shows the mean percentage of correct responses for the 31 Ss who completed the comprehension task as a function of sentence type.

Insert Figure 1 about here

The task required S to select one of a pair of pictures for each sentence given; the probability of the observed mean percentage of correct responses for each sentence type was determined by means of a binomial test, given a chance probability of success of $p = .50$.

The probabilities of the observed mean percentage of correct responses to passive ($\bar{X} = 48.4$, $SD = 27.62$, $p < .61$) and negative passive ($\bar{X} = 50.4$, $SD = 29.19$, $p < .87$) sentences were within chance levels. The probability of the observed mean percentage of correct responses was $p < .08$ for declarative sentences ($\bar{X} = 58.7$, $\underline{SD} = 32.42$) and $\underline{p} < .02$ for negative declarative sentences ($\bar{X} = 37.6$, $\underline{SD} = 29.15$).

Kendall's coefficient of concordance, corrected for ties, was used to discover whether Ss' comprehension scores were ordered similarly across different levels of grammatical complexity. Significance levels were determined by calculation of χ^2. The coefficient of concordance obtained ($\omega = .415$) was significant at the .05 level ($\chi^2 = 45.02$). Since there was a significant association of scores across sentence types, a single comprehension score was used to test for association of IQ and CA with comprehension ability. The mean percentage of correct responses for each S across all sentence types was used as a summary score, and the association of CA and IQ with comprehension performance was tested by means of Kendall's tau, corrected for ties, with significance determined by calculation of z (Siegel, 1963). CA and IQ were significantly associated with each other ($tau = -.23$, $\sigma_{tau} = .13$, $\underline{p} < .04$), but neither CA nor IQ were significantly associated with comprehension scores ($tau_{CA} = -.05$, $\sigma_{tau} = .13$, $\underline{p} < .35$; $tau_{IQ} = +.06$, $\sigma_{tau} = .13$, $\underline{p} < .32$).

Study II. Imitation

Method

Subjects. The same Ss were used for both the comprehension and imitation tasks.

Procedure. Following presentation of all eight stimulus sentences in the comprehension task (See Table 1), the pictures were removed and E said, "Now say just what I say. O.K.?" The eight sentences were repeated, with the passives and negative passives truncated by deletion of the "by" clause so as roughly to equate length of all the sentences.

Results

Responses of nine Ss were not available because they were unwilling to perform the task.

Figure 2 shows the mean percentage of correct responses to each sentence type for the 31 Ss who completed the imitation task.

Insert Figure 2 about here

The following orthogonal breakdowns were made of the hypotheses relative to comparisons among K, N, P, and NP sentences on the imitation task:

1. Imitation of kernel (K) sentences (obligatory transformations only) would be significantly better than the imitation of sentences to which one or more optional transformations were applied (N, P, and NP sentences).
2. Imitation of sentences to which one optional transformation was applied (N and P sentences) would be significantly better than imitation of sentences to which two optional transformations were applied (NP sentences).
3. Imitation of sentences to which a passive (P) transformation was applied would be significantly better than imitation of sentences containing a negative (N) transformation.

These hypotheses were tested through _a priori_ individual comparisons among sample means (Hays, 1963). The percentage of correct responses was used as the measure of performance ($\bar{X}_K = 40.3$, _SD_ = 43.22; $\bar{X}_P = 31.5$, _SD_ = 45.30; $\bar{X}_N = 33.9$, _SD_ = 41.90; $\bar{X}_{NP} = 27.4$, _SD_ = 37.56; MS error = 617.28, _N_ = 31). Table 2 shows the results of these comparisons.

Insert Table 2 about here

To a significant degree ($p < .05$), declarative sentences were more correctly imitated than were sentences to which optional transformations had been applied.

Kendall's coefficient of concordance, corrected for ties, was used to discover whether _Ss_' imitation scores were ordered similarly across different levels of grammatical complexity. Significance levels were determined by calculation of χ^2. The coefficient of concordance obtained ($\omega = .73$) was significant at the .01 level ($\chi^2 = 70.4$). Since the association of scores across sentence types was significant, the mean percentage of correct responses for each _S_ across all sentence types was used as a summary score in testing the association of IQ and CA with imitation ability. The association of CA and imitation scores was not significant (tau = -.08, σ tau = .13, $p < .50$), but IQ and imitation were strongly associated (tau = +.41, $\sigma_{tau} = .13$, $p < .001$). Since CA and IQ are strongly associated with each other (tau = -.23,

$\sigma_{tau} = .13$, $p < .04$), it was decided to partial out the effect of CA from the IQ-imitation association as described in Siegel (1956). This step led to a lower imitation-IQ association ($tau_{I-IQ:CA} = .33$). The significance level associated with this coefficient is not known.

Discussion

Simple declarative sentences appear to be within the comprehension ability of the TMR Ss in this study. However, the negative sentences were comprehended less often than would be expected if Ss randomly selected pictures following sentence presentations. The results suggest that TMRs may react to negative declarative sentences by ignoring the negation transformation and responding to each sentence as if it were an affirmative declarative string--resulting in consistent selection of the wrong picture. This finding may be evidence of a lack of competence in the processing of sentences such that the effect of transformations on the base strings is not considered by S. The results also appear consistent with the prevalent hypothesis that TMRs do not attend to relevant cues (i.e., negative markers) in learning tasks (see Zeaman & House, 1963).

The mongoloid TMR Ss did not appear to comprehend the passive and negative-passive sentence stimuli presented to them. They either responded randomly to such strings or used decoding strategies which resulted in responses that were not correlated with those demanded by the task.

Neither IQ nor CA was significantly associated with comprehension. Thus, for TMR children, the ability tested is apparently not one which can be expected to develop with increasing CA or to be more pronounced at relatively higher IQ levels. However, since Slobin found a significant association of CA and comprehension in normal children but no association of IQ and comprehension, the failure to obtain an association of comprehension and CA may reflect the limited range of abilities of Ss in the study. With a wider range of scores and CAs there might be a significant association of CA and comprehension such as was found by Lenneberg, Nichols, and Rosenberger (1964).

With normal adults, Gough (1966) found no difference between comprehension of passive and truncated passives. It is not known, however, whether this result holds for the TMR Ss in the present study. An important factor in the inability of our TMR Ss to comprehend passive and negative passive sentences may well have been the length of these strings (eight words for passive strings, nine words for negative passive strings), which perhaps lay beyond their immediate memory span. However, since the P and NP sentences were comprehended better than the shorter N sentences (7 words), it appears unlikely that sentence length was the only factor influencing performance on the comprehension task.

In the comprehension task, even the declarative and negative strings were longer than the apparent ceiling levels of three words or four digits obtained in an unpublished study conducted by the investigators with the same Ss (Semmel & Greenough, unpublished). Ss were able to decode declarative sentences which were six words long, and they even appear to have decoded the seven-word negative strings, ignoring, to be sure, the negation transformation and treating the sentence as if it were an affirmative declarative string.

Performance on the task is highly dependent upon attention. There is considerable evidence that retarded individuals have greater difficulty in attending to tasks when their motivation or general level of arousal is low (Semmel, 1965; Denny, 1964). Nevertheless, differences in the comprehensibility of sentences as a function of syntactic and semantic structure were found with these TMR Ss; the paradigm used in the present study may therefore be useful for assessing linguistic abilities of TMR children in clinical situations.

The relevant variable in the imitation task appeared to be the presence or absence of optional transformations. Ss were able to imitate simple declarative sentences significantly better than sentences to which optional grammatical and/or semantic transformations had been applied. The results further indicate that IQ is significantly associated with imitation ability in mongoloid TMR Ss. This result differs from Lenneberg's, who found no such significant association among the mongoloid Ss in his sample (Lenneberg et al., 1964).

Sentence length may have been an important factor in the imitation task, with Ss unable to hold the longer, transformed sentences in immediate memory. However, the shortest sentence form in the imitation task was the truncated passive sentence (five words). Next longest were the simple declarative and negative passive forms (six words each). The longest form was the simple negative (seven words). So, if length of sentence stimuli affected imitation ability in this task, we would expect the scores to be ordered as follows P < (K = NP) < N. In fact, though, the declaratives were imitated significantly better than the sentences that included optional transformations. Differences among the other sentence types are not significant but in any case are not so ordered that the shortest sentences are imitated best. Instead, the seven-word negative is imitated better than the five-word passive which is, in turn, better imitated than the six-word negative passive.

Thus, there is some evidence that Ss made use of the syntactic structure of the sentence stimuli, perhaps coding the semantic relations and a base-structure-like description of the syntactic structure. With the TMR Ss in this study, utilization of such a technique to decode, store, and encode sentences is difficult when the sentences involve optional semantic and/or syntactic transformations.

Although Gough (1965; 1966) and Slobin (1966) found comprehension to be more difficult when the semantic negative transformation was applied than when the syntactic passive transformation was, there was no significant difference in S performance on the two types of strings in either the comprehension or imitation tasks of the present study. Since Slobin (1966) found that syntactic and semantic features of stimuli could account for performance of normal children with CA's of at least six years, Ss in the present studies may have been functioning at too low a level to utilize these linguistic factors completely.

The superior understanding and imitation of declaratives as against other types of sentences could also reflect a difference in the Ss' familiarity with the sentence types. Siegel (1963) studied the language behavior of adults and retarded children in interpersonal associations. The mean length of adult response (MLR) in such situations was considerably lower than the norms provided by Mildred Templin (1967) for utterances of normal eight-year-olds; adults also used fewer responses, shorter MLR's, and lower type-token ratios (TTR) with low-level than with high-level MR Ss. They also used significantly more questions. Adults associating with mongoloid TMR children may limit their verbal interaction to simple statements and questions and thus impoverish the verbal environment of such children. TMR children, having little acquaintance with complex sentences, would be reluctant to repeat them.

Thus, the factors of sentence length, syntactic and semantic complexity, and familiarity with sentence forms could, separately or in combination, account for the performance of the Ss in the present studies. All of these factors seem to contribute to the complexity of a sentence. Incorporation of transformations into a sentence generally increases the length as well as the syntactic and/or semantic complexity. An unfamiliar sentence form or a sentence with unusual, unfamiliar words is also a complex string and is difficult to decode and store.

The most significant finding in these two studies would appear to be that TMR children comprehend simple negative sentences as if they were affirmative declarative strings. It is not clear whether this phenomenon is the result of inadequate competence or performance.

Mongoloid TMR children may lack the competence to process a negative sentence into an underlying kernel plus semantic transformation. They may, instead, extract a kernel-like structure similar to that of the sentences they normally hear and exhibiting a relationship of agent to recipient opposite to that in the base string underlying the negative sentence. On the other hand, these children may have the competence to deal with negative sentences but fail to attend to the negative marker in the surface structure, and thus treat the sentence as if it were an affirmative string. Further studies in which the negative marker is strongly emphasized by the E through intonational stress and gesture may help determine whether it is primarily competence or performance variables that affect the comprehension of negative sentences.

References

Chomsky, N. Aspects of the theory of syntax. Cambridge, Mass.: M.I.T. Press, 1965.

Denny, M. R. Research in learning and performance. In H. A. Stevens & R. Heber (Eds.), Mental retardation. Chicago: Univ. of Chicago Press, 1964. Pp. 100-142.

Gough, P. B. Grammatical transformations and speed of understanding. Journal of Verbal Learning and Verbal Behavior, 1965, 4, 107-111.

Gough, P. B. The verification of sentences: The effects of delay of evidence and sentence length. Journal of Verbal Learning and Verbal Behavior, 1966, 5, 492-496.

Hays, W. L. Statistics for psychologists. New York: Holt, Rhinehart, & Winston, 1963.

Lenneberg, E. H., Nichols, I. A., & Rosenberger, E. F. Primitive stages of language development in mongolism. Disorders of communication, Vol. XLII: Research publications, A.R.N.M.D. Baltimore: Williams & Wilkins, 1964.

Semmel, M. I. Arousal theory and vigilance behavior of educable mentally retarded and average children. American Journal of Mental Deficiency, 1965, 70, 38-47.

Semmel, M. I., & Greenough, D. E. Immediate memory span of mongoloid children for verbal material as a function of semantic and syntactic bonds between words. Unpublished.

Siegel, G. M. Language behavior of adults and children in interpersonal assemblies. Journal of Speech and Hearing Disorders, 1963 (Monogr. Suppl. 10), 32-53.

Siegel, S. S. Nonparametric statistics for the behavioral sciences. New York: McGraw-Hill, 1956.

Slobin, D. I. Grammatical transformations and sentence comprehension in childhood and adulthood. Journal of Verbal Learning and Verbal Behavior, 1966, 5, 219-227.

Templin, M. Certain language skills in children. Minneapolis: University of Minnesota Institute on Child Welfare Monograph No. 26, Univ. of Minnesota Press, 1957.

Zeaman, D., & House, B. J. The role of attention in retardate discrimination learning. In N. R. Ellis (Ed.), Handbook of mental deficiency. New York: McGraw-Hill, 1963. Pp. 159-223.

Table 1

Sentence Stimuli for the Comprehension Task

A. 1. The dog is being chased (by the cat). *
2. The dog is not chasing the cat.
3. The dog is chasing the cat.
4. The cat is being chased (by the dog).
5. The dog is not being chased (by the cat).
6. The cat is not chasing the dog.
7. The cat is not being chased (by the dog).
8. The cat is chasing the dog.

B. 1. The ball is not being hit (by the clown).
2. The ball is not hitting the clown.
3. The ball is hitting the clown.
4. The clown is hitting the ball.
5. The ball is being hit (by the clown).
6. The clown is hitting the ball.
7. The clown is not being hit (by the ball).
8. The clown is being hit (by the ball).

C. 1. The ball is not hitting the flowers.
2. The ball is not being hit (by the flowers).
3. The flowers are being hit (by the ball).
4. The flowers are not hitting the ball.
5. The ball is hitting the flowers.
6. The flowers are not being hit (by the ball).
7. The ball is being hit (by the flowers).
8. The flowers are hitting the ball.

D. 1. The girl is being kicked (by the boy).
2. The girl is kicking the boy.
3. The boy is not being kicked (by the girl).
4. The boy is being kicked (by the girl).
5. The boy is kicking the girl.
6. The girl is not being kicked (by the boy).
7. The girl is not kicking the boy.
8. The boy is not kicking the girl.

*Expressions in parentheses were deleted in the imitation task (Study II).

Table 2

Summary of Orthogonal Comparisons of Relationship Between Level of Grammatical Complexity and Imitation Scores

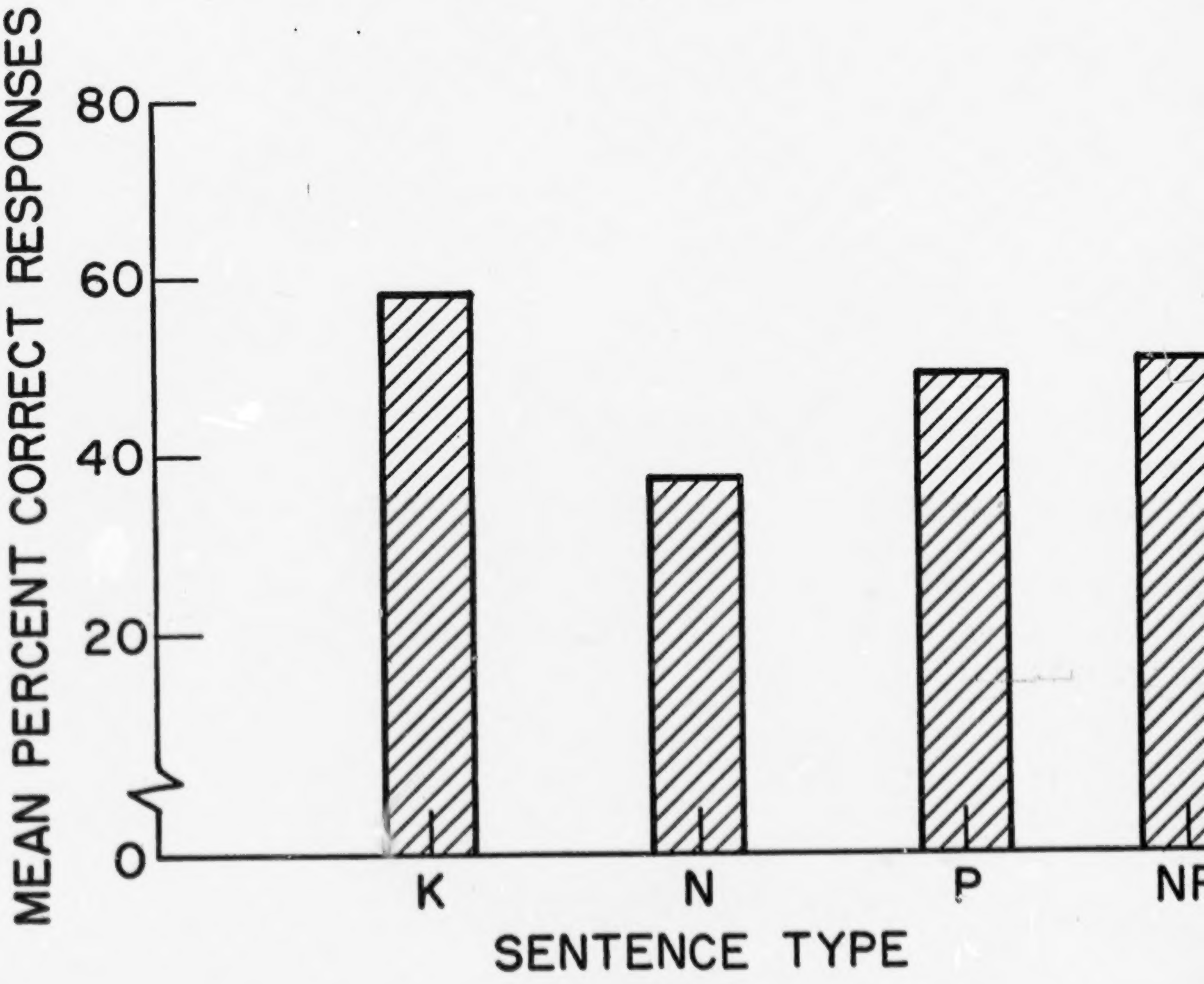
	Orthogonal Comparisons		
Hypotheses:	Obligatory Transformations vs. Optional Transformations	One Transformation vs. Two Transformations	Syntactic Transformation vs. Semantic Transformation
$\hat{\Psi}$	9.37	5.3	2.4
Est. Var. ($\hat{\Psi}$)	26.54	29.87	39.82
t	1.82*	0.97	0.38

$^{*}p < .05$

Figure Captions

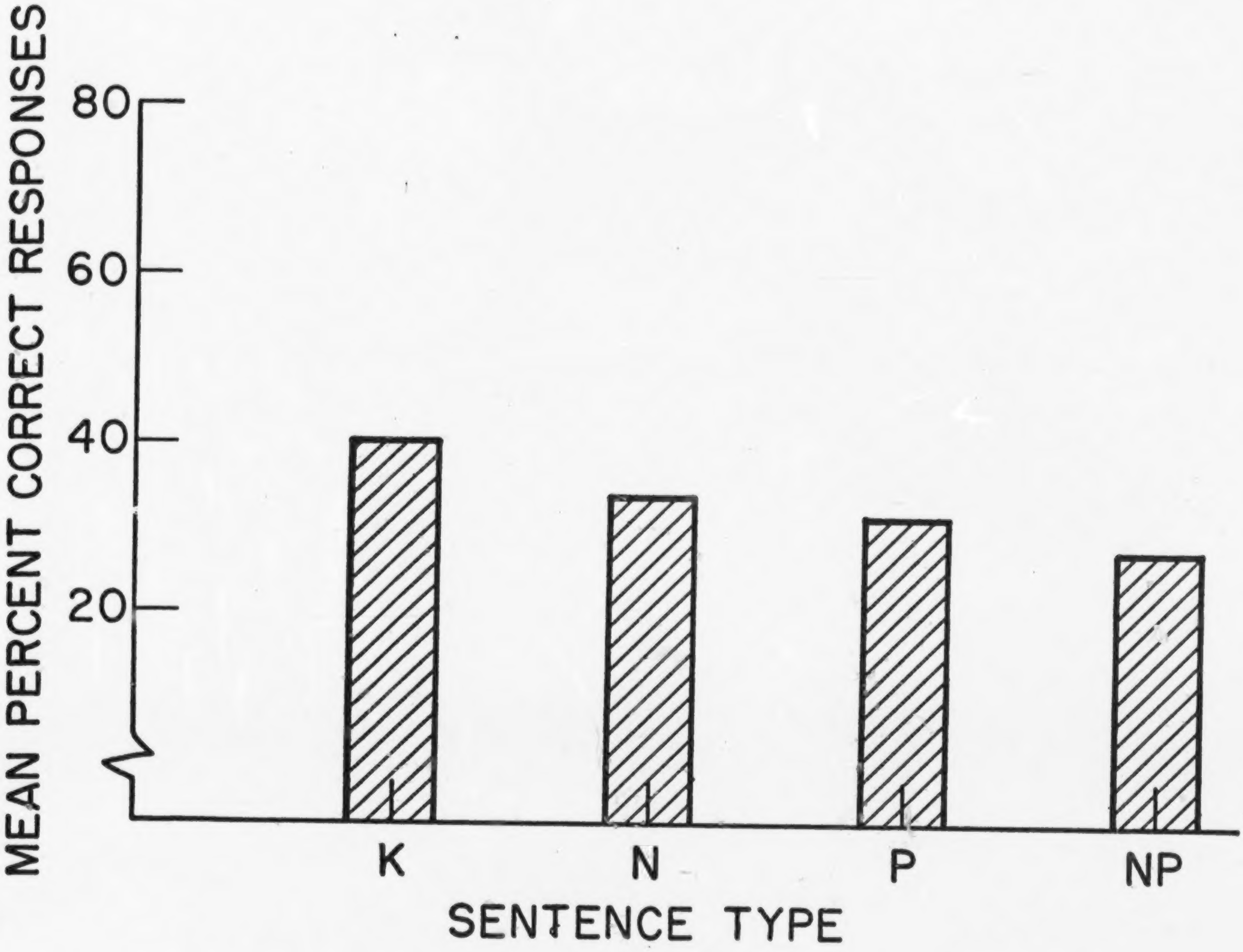
Fig. 1. Mean percentage of correct comprehension responses as a function of sentence type.

Fig. 2. Mean percentage of correct imitation responses as a function of sentence type.



COMPREHENSION TASK

Figure 1



IMITATION TASK

Figure 2

Chapter IV

THE BRAIN AS A MIXER, I. PRELIMINARY LITERATURE REVIEW: AUDITORY INTEGRATION

Melvyn I. Semmel, Dale Lewellyn, Gillian Lowes, and Judith Agard

Center for Research on Language and Language Behavior
The University of Michigan

In a review of earlier work on techniques for studying central auditory integration, Matzker's (1958) binaural fusion procedure emerges as the most promising method for measuring binaural integration abilities.

Progress has been slow in developing methods to evaluate central hearing deficiencies. Patients with central lesions are often judged by the otologist to have essentially normal hearing. The reason is the bilateral cerebral cortical representation of hearing for each ear: because each ear projects to both sides of the brain, a lesion within the brain must be enormous and probably lethal (covering auditory areas on both sides of the brain) before it results in deafness measurable by a conventional hearing test. More sensitive tests of auditory discrimination often involve the patient's intelligence, education, and memory, as well as his hearing, and so produce results that are difficult to interpret.

One of the first break-throughs on this problem came in the early 1950's when Bocca (1955) and his colleagues showed that the ability to understand distorted speech was modified substantially in the contralateral ear of patients with temporal lobe tumors. The patients had essentially normal hearing for pure tones and undistorted, ordinary speech, but when the speech signal was distorted by low-pass filtering, acceleration of rate, periodic interruption, or artificially scanning speech, the discrimination scores were significantly lower for the ear opposite the side of the pathological temporal lobe.

Bocca's finding suggested a new use for two standard tests of auditory discrimination which were in wide use at the time. The Rush-Hughes (RH) and W22 tests both involved delivering 50 phonetically balanced (PB) monosyllabic words and asking the subject to repeat each word. Individually, the tests were ineffective in diagnosing brain damage, but it turned out that in combination they could.

Investigators had noticed that the RH test consistently resulted in 20% more errors than the W22, apparently as a result of distortion in the RH recordings and of the clipped and speedier method of presenting the words. A difference in score greater than 20% between the two tests was found to indicate a disturbance in the auditory areas of the temporal lobes; and it was particularly in the ear contralateral to the damaged hemisphere that such a difference would appear (Goetzinger, Dirks, & Baer, 1960). Apparently the greater difficulty of the RH test functions in the same manner as the distortions of speech in Bocca's work.

Jerger (1954) provided further evidence from 24 patients with organic CNS disease. He used five monaural tests, three of them simple tests of the type developed by Bocca and his colleagues. The UL or "undistorted loud" test required subjects to repeat 50 PB words which were presented 50 db above threshold. The UF or "undistorted faint" test delivered 50 PB words at only 30 db above threshold. The LPFS, or "low-pass filtered speech" test, delivered 50 PB words with a 500 cps filter, so that the words were muffled and difficult to understand.

The two other tests differed from the others in that they involved a primary signal to which the listener had to attend in the presence of a secondary or competing signal on the non-test ear. Test #2 presented 50 PB words (50 db above threshold) to one ear, while a different speaker simultaneously read a complete sentence to the other ear at a level 10 db more intense than the PB words. The subject had to ignore the sentences in one ear and repeat aloud the PB words he heard in the other. Test #3 was similar to test #2 except that the test signal was a complete sentence requiring a multiple-choice answer, and the competing signal on the other ear was the continuous discourse of two different speakers.

Scores for all of these tests were determined separately for the two ears, the ear homolateral and the ear contralateral to the affected side of the brain.

Jerger presented results for four groups of subjects. Group A consisted of seven patients with low-brain-stem lesions (below the cochlear nucleus) presumably not involving the auditory system. These patients, as expected, showed normal test results, with no difference between the two ears on any of the five tests. Group B consisted of seven patients with unilateral brain-stem damage involving the auditory system. The tests showed a 20% decrease in number of correct responses for the ear contralateral to the damage. The only exception was in test #3, where performance was good on both ears.

Group C consisted of six patients with unilateral temporal lobe lesions involving Herschl's gyrus. The results were quite similar to those for Group B, except that in tests #2 and #3 the contralateral ear showed a much poorer response. In Group D, designed as a control for Group C, four subjects with parietal, frontal, or remote temporal cortical lesions were tested. A slight (5-10%) difference between the two ears was found. The authors suggested that the auditory system had sustained some secondary damage during the neurosurgical procedures to which all the patients of this group had been subjected.

In summary, the PB monaural tests apparently detected auditory brain-stem or cortical lesions. The only test differentiating between locations, however, was test #3. The authors concluded that it was too soon to comment on the diagnostic value of any of these tests. Many more subjects had to be tested and the location of the central lesions checked. To be sure, the tests supported Bocca's findings of decreased ability to understand some signals in the contralateral ear of patients with temporal lobe tumors; however, they also showed that brain-stem damage could lead to the same result. What was needed was a test that could localize the area of damage. Again it was Bocca (1961) who suggested the method to aid in solving this problem. It involved simultaneously delivering different signals to the two ears, and studying the synthesis or integration of these messages.

This phenomenon of bilateral fusion or integration has an interesting history. Throughout the nineteenth and early twentieth centuries most people thought that there was no real binaural summation of intensity or loudness, but simply a sensation of greater clarity and fullness of sound. However, later studies of summation at threshold gave substantial evidence that at the level of the CNS a nearly perfect summation of the stimuli heard by the two ears does occur. An experiment by Bocca (1955) gave clear evidence of this summation. He used both nonsensical and meaningful disyllabic words. First he presented to one ear a normal voice delivering these words and lowered the intensity until the subject was unable to identify and repeat more then 30% of the words. Then to the other ear he presented the same words at 45 db above threshold, using a 500 cps low-frequency band-pass filter to distort the syllables. With this arrangement, subjects were unable to articulate more than 50% of the words. When both stimuli were delivered together to one or both ears by means of loudspeakers, the louder stimulus behaved as a masking stimulus of the weaker one, and discrimination remained equal to that observed for the suprathreshold distorted stimulus alone. However, when the two stimuli were delivered through earphones separately and simultaneously to the two ears, binaural discrimination was approximately equal to the arithmetic addition of the two monaural discriminations: articulation jumped to 80% or 90%. During this binaural stimulation, the subjects thought they were hearing only suprathreshold stimulation and were unaware of the contralateral subthreshold stimulus except that the voice became suddenly "much clearer" when it was introduced.

Bocca concluded that with one ear thus providing power and the other ear providing quality, he had produced clear evidence of binaural summation and of binaural integration. He did not immediately speculate on the exact site of this process, but it was clear that if the site could be determined, the method might be fruitful for diagnosis of specifically localized brain damage.

The Jerger study cited earlier marked an initial attempt to localize integration. In Jerger's binaural test, called the SWAMI, or "speech with alternating masking index," 50 words were presented to both ears simultaneously, but a much louder masking noise, 20 db more intense than the speech, was switched once a second from one ear to the other. Under this masking noise, intelligibility was quite poor on either ear separately, but the two monaural signals complemented each other in time and intelligibility was not appreciably impaired. The normal brain apparently fused the speech information from the two ears effectively.

Semmel, Lewellyn, Lowes & Agard

The SWAMI results showed a 20% reduction for both the cortical and brain-stem auditory-damaged groups, which was no more than would be expected from the normal 20% reduction in basic PB scores on the contralateral ear. This negative finding was unexpected, since integration was expected to take place in the brain stem. The authors spoke of other evidence, without citing it, to support their suggestion that the mechanism of binaural fusion was situated at a relatively low level in the brain stem and was not appreciably affected by lesions at only slightly higher levels. Presumably they were identifying the trapezoid fibers as responsible for integration, but the evidence for such a locus is negative rather than positive. The problem of localization has certainly not been solved.

A different kind of test which seemed to involve some kind of binaural integration was suggested by Sanchez-Longo and Forster (Matzker, 1958), who studied the ability to localize sound in patients with brain tumors. Using "white noise" as their test signal, they demonstrated that in patients with tumors of the temporal lobe a sound source is lateralized to the contralateral side. In patients with lesions in other cerebral regions, they found no deficits in ability to localize sound.

Matzker (1958) used this same technique, varying interaural time differences for pure-tone signals of frequencies between 125 Hz and 8000 Hz, which were interrupted at regular intervals. The smallest time interval used was 0.018 msec., which was long enough to cause a definite lateralization of the imaginary sound source to the side where the signal arrived first. The greater the time difference, the more lateral the sound seemed to become. At an interval of 0.648 msec., in normal subjects, the source appeared to have moved to a position exactly 90° off the median plane.

The investigator started testing Ss with the maximal interaural time difference and decreased the interval in steps. The zone of mid-line impression, or "localization band" was established for each subject. With increasing age, the band was found to widen considerably.

Matzker tested more than 400 patients with this technique. He found that a deviation of the localization band occurred in cases of cerebral lesion on the contralateral side or brain-stem lesions on the homolateral side. He defined the dividing line above which contralateral localization and below which homolateral localization occurs in the ventral brain stem. "Ventral brain-stem" is an unclear term, though; presumably Matzker was suggesting that only lesions in the trapezoid fibers cause a deviation in localization toward the homolateral side. Since deviations are also found at all other levels of the auditory system, however, the trapezoid fibers cannot be identified as a specific site for integration involved in localization. Lesions in frontal, parietal, and occipital lobes, as well as in the temporal lobe, also contributed to abnormal localization. And with each individual, it was necessary to insure that deviations were not caused by unilateral peripheral impairment. In short, the sound localization test appears inadequate to localize brain-stem lesions.

Matzker therefore developed a "selective test of the central auditory connections in the brain stem," designed to explore the integration of signals travelling in the bilateral auditory pathways. He was particulary interested in damage involving the medial geniculate body, which he believed "collects all the fibers from the homo- and contralateral sides and relays them to the cortex on the same side." Matzker's picture of the auditory pathways differs from the traditional anatomical diagrams (see Crosby, Humphrey, & Lauer, 1962, p. 276); Figure 1 taken from Matzker (1958) in simplified form shows the auditory pathway from one ear:

Insert Figure 1 about here

In Matzker's test two simultaneous but individually meaningless sounds are presented, one to each ear. Words are split by narrow band-pass filters into a low-frequency band (500-800 Hz), which is presented to one ear, and a high-frequency band of the same word (1500-2500 Hz), which is presented to the other ear. The single band is virtually unintelligible: no more than 20% of the words in it can be recognized. However, there is excellent integration of the two components, since together they permit almost 100% recognition when the test is given to normal subjects. The integration presumably takes place in the brain stem, after which impulses are transmitted to the cerebral cortex, where the frequencies are translated into speech (Matzker, 1960).

On tests with more than 1700 subjects, Matzker obtained results that accorded with his theoretical predictions. In almost all cases of cerebral tumor in all brain regions, test results were positive (84%). A high proportion of recent head injuries gave a positive result, with the binaural test reverting to negative as other symptoms disappeared. The test was also negative with all psychotics, most epileptics, and patients with multiple sclerosis. In subjects over 70 years of age, the test was always positive, presumably because of the physiological loss of ganglionic cells with age.

In two cases in which the binaural test gave positive results, autopsy revealed tumors away from the brain stem, in the cerebellum or in the frontal lobes, but no macroscopic abnormalities in the brain-stem or auditory pathways. However, microscopic sections showed hemorrhaging, intravascular clotting, and other signs of circulatory disturbance in the brain stem. Moreover, nerve cell nuclei, *Nissl* granules, and cytoplasm clearly showed degenerative changes. Apparently a reflex circulatory disturbance through the brain stem had led to an insufficient supply of oxygen to its nuclei. As a result the functioning of the *synaptic* connections in the brain stem was impaired.

Harris (1963) used Matzker's binaural test on 25 brain-damaged and 25 normal subjects. He found a significant difference between the two groups. In two larger studies, using 175 subjects aged 7 through 20, Harris again found that subjects with organic symptoms showed poorer integration than subjects with only functional symptoms presumably arising from "psychological" causes. He found no significant relationship between auditory integration and age, sex, obstetrical history, birth conditions, or levels of reading ability.

A more recent study of Matzker's fusion test (Hayashi et al., 1966) adds some significant information. Hayashi widened the scope of Matzker's study by presenting the signals at several different intensity levels and by introducing the additional testing conditions here diagrammed:

Insert Figure 2 about here

Among 78 subjects he found five cases of poor binaural fusion: two head injuries, one temporal lobe epilepsy, one cerebellar ataxia, and one sensorineural deafness of unknown cause. All cases of inner ear impairment showed a normal pattern of binaural fusion and so lent support to Matzker's belief that the test indicates damage to central rather than peripheral auditory mechanisms. However, the most interesting result was the tendency of poor binaural function to occur when the high band was connected to the ear opposite the side of the affected cerebral area. For example, in one case of head injury poor binaural function was found only when the signals from the high-band filter were given to the left ear; the function was normal when the signals were given to the right ear.

Hayashi concluded that the site of binaural fusion could not be the brain stem, since "synapses of auditory pathways are closely gathered in a relatively narrow place in the brain stem and lesions in the area would cause poor binaural function regardless of the side of the ear receiving the signals passing through the high band or the low one." The laterality of the results suggest to him that the site of binaural fusion is "the cortical or subcortical area."

Preliminary Conclusions

It appears reasonable to extract the following implications from the above review: Matzker's procedure is probably inadequate as a general test to detect brain damage, since many areas of the brain may be damaged without affecting performance on the test--particularly in the case of small lesions outside the auditory pathways or even involving fibers that are within the auditory system but play no role in integration.

Furthermore, Matzker's test may have only limited promise as a test to localize brain damage. It is not all clear where binaural integration takes place, whether at the level of the trapezoid fibers, or of the cochlear nuclei, or of the nucleus of the lateral lemniscus, or of the inferior colliculus, or of the cortex, or of any combination of these. And even if the loci of auditory integration were determined, lesions in remote areas, by causing vascular damage to the relevant areas, might still make it extremely difficult to detect the loci of the major lesion.

Obviously, far more direct validation of Matzker's procedure is necessary by studying the binaural integration abilities of patients with a clear pathology and histology that gives the exact location and nature of the brain damage.

Although Matzker's procedure may be inadequate to diagnose specific brain injury, it has particular promise as a technique for studying an organism's binaural integration abilities. Little, if anything, is known about the relationship of this ability to other performance variables. Hence, further exploration and development of the procedure appear warranted.

References

Bocca, E. Binaural hearing: Another approach. Laryngoscope, 1955, 65, 1164-1171.

Bocca, E. Factors influencing binaural integration of periodically switched messages. Acta Otolaryngolica, 1961, 53, 142-144.

Bocca, E., & Calearo, C. Central hearing processes. In J. Jerger (Ed.), Modern developments in audiology. New York: Academic Press, 1963. Pp. 337-371.

Crosby, E. L., Humphrey, T., & Lauer, E. W. Correlative anatomy of the nervous system. New York: Macmillan, 1962.

Goetzinger, C., Dirks, D., & Baer, C. Auditory discrimination and visual perception in good and poor readers. Annals of Otology, Rhinology, and Laryngology, 1960, 69, 121-136.

Harris, R. Central auditory functions in children. Perceptual and Motor Skills, 1963, 16, 207-214.

Hayashi, R., Ohta, F., & Morimoto, M. Binaural fusion test: A diagnostic approach to the central auditory disorders. International Audiology, 1966, 5, 133-135.

Jerger, J. Auditory tests for disorders of the central auditory mechanism. In W. Fields and B. Alford (Eds.), Neurological aspects of auditory and vestibular disorders. Springfield, Ill.: Charles C. Thomas, 1954. Pp. 77-86.

Matzker, J. Two new methods for the assessment of central auditory functions in cases of brain disease. Annals of Otology, Rhinology, and Laryngology, 1960, 69, 121-136.

Matzker, J., & Ruckes, J. A new hearing test for the diagnosis of brain stem lesions. German Medical Monthly, 1958, 3, 258-260.

Thompson, R. F. Foundations of physiological psychology. New York: Harper and Row, 1967. Pp. 259-275; 332-346.

Wolman, B. B. (Ed.), Lesions of the temporal cortical area and disturbances of auditory gnosis: Sensory aphasia. In Handbook of clinical neurology. New York: McGraw-Hill, 1965. Pp. 715-720.

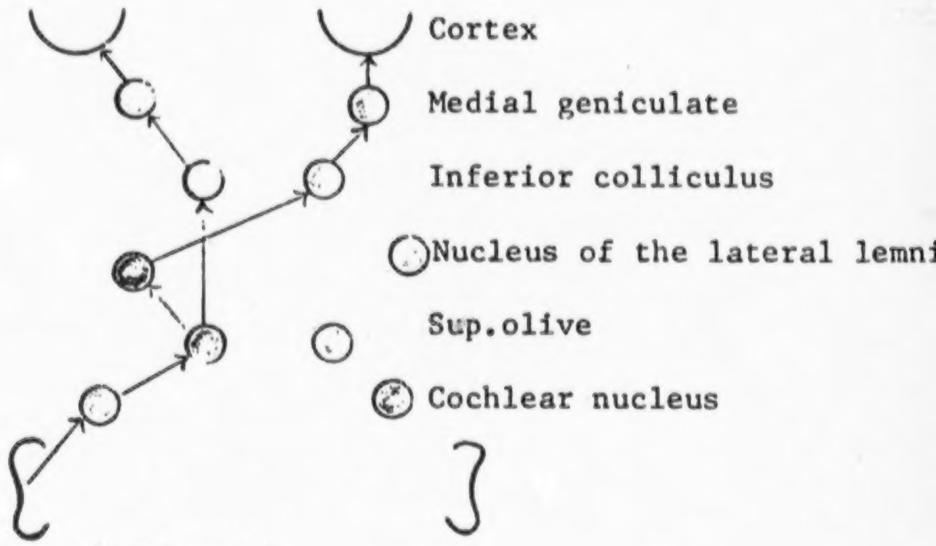

Cortex
Medial geniculate
Inferior colliculus
Nucleus of the lateral lemni
Sup.olive
Cochlear nucleus

Figure 1

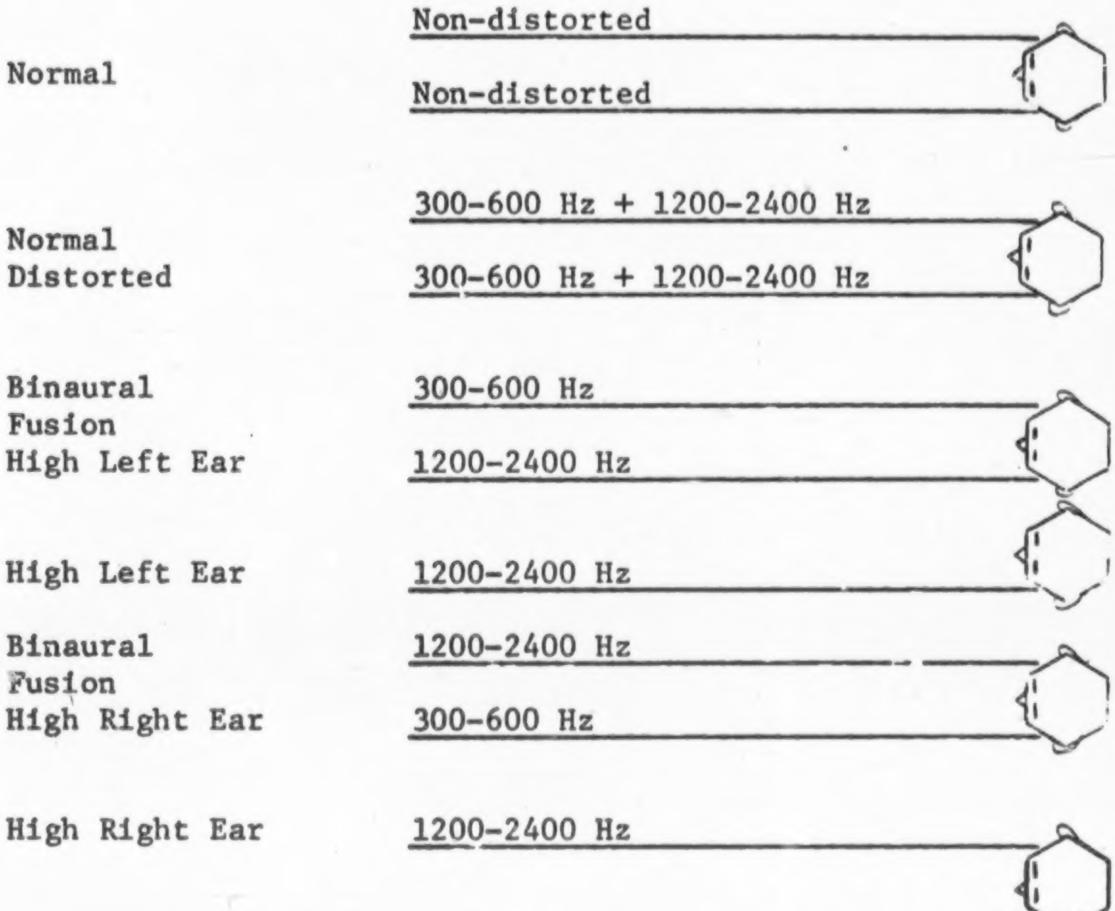

Normal
Non-distorted
Non-distorted
Normal
Distorted
300-600 Hz + 1200-2400 Hz
300-600 Hz + 1200-2400 Hz
Binaural
Fusion
High Left Ear
300-600 Hz
1200-2400 Hz
High Left Ear
1200-2400 Hz
Binaural
Fusion
High Right Ear
1200-2400 Hz
300-600 Hz
High Right Ear
1200-2400 Hz

Figure 2

Chapter V

THE BRAIN AS A MIXER, II. A PILOT STUDY OF CENTRAL AUDITORY INTEGRATION ABILITIES OF NORMAL AND RETARDED CHILDREN

Melvyn I. Semmel, Judith A. Agard, and Jerry L. Olson

Center for Research on Language and Language Behavior
The University of Michigan

Matzker's (1958) technique for the study of central auditory integration abilities was modified and piloted with 5 normal and 6 retarded children. 2 frequency filter systems were used: System 1 presented frequencies from 425 to 1275 Hz in one band and 2550 to 6800 Hz in the other; System 2 presented frequencies from 637 to 1275 Hz and from 2550 to 5100 Hz.

Ss were asked to repeat 40 words presented under 4 conditions: high frequency pass only, low frequency pass only, high and low frequency stimuli to separate ears simultaneously (binaural integration condition), and both frequency bands to both ears simultaneously (normal binaural conditioning).

Results are presented and discussed relative to methodological problems with the techniques used. Performance under the 4 presentation conditions is compared for the 2 filter pass systems, the type and age of Ss (normal vs. retarded), and the specific word stimuli used.

The diagnosis and localization of brain injury among exceptional children has been the subject of considerable interest (Strauss & Lehtinen, 1947). Matzker (1958) has developed a promising technique to assess the brain's ability to integrate sounds. The approach involves separating a meaningful auditory stimulus (e.g., a word) into its high and low frequencies. Presentation of either the high or low frequencies alone results in an extremely low probability of stimulus recognition. Simultaneous presentation of the two components requires S to integrate the two frequencies centrally--thus increasing the probability of stimulus recognition. Matzker used two filter passes (500-800 Hz and 1815-2500 Hz) without explaining the rationale or criteria for selecting these passes.

Matzker (1958) presented evidence that patients with brain pathology could not integrate two frequency bands presented simultaneously, one to an ear. However, Ss could recognize words when the two frequency bands were presented simultaneously to both ears.

Binaural integration of the elements of simultaneously presented meaningful stimulus is purported to take place in the brain stem where the two auditory pathways from either side are interconnected (Bocca & Calearo, 1963). The brain stem is apparently the source of many contralateral efferent impulses which activate or inhibit peripheral excitability. Normal auditory integration suggests that the synaptic connections in the brain-stem region are intact and functioning. Poor integration may reflect faulty synaptic function within the brain stem. According to Matzker (1958), faulty integration may result from the loss of ganglionic cells within the primary auditory centers, specifically at the level of the cochlear nuclei and of the medial geniculate bodies. As evidence for his hypothesis, he adduces the results of autopsies performed on adults known to have had poor auditory integration abilities.

Harris (1963) used Matzker's technique with normal and brain-injured Ss. In a pilot study of 25 normal and 25 brain-injured children he found a significant difference, but in an expanded study of 70 brain-injured and 96 normal children he found no significant differences in binaural integration.

The purpose of the pilot research here reported was to explore the relative binaural integration abilities of 12 exceptional and normal children. The study differs in three respects from Harris's (1963). First, two different systems of frequency filtering were piloted. Second, Ss were presented with the same words under four conditions: high frequency only, low frequency only, high and low frequencies to separate ears (integration condition), and both frequencies to both ears (normal binaural condition). Finally, stability of responses was assessed through the presentation of the stimulus list over two trials.

Method

Subjects. Ss were six educable mentally retarded (EMR) boys from Wayne County Child Development Center (IQ range 50-80) and six normal boys attending regular public school classes. The chronological age of the EMR Ss was 8 to 13 years ($\bar{X} = 10.0$). The normal Ss' CA ranged from 7 to 12 ($\bar{X} = 8.0$). The Ss had no known hearing difficulties and no major articulation problems.

Filtering system. The two frequency filtering systems used were selected from six different filter systems, including the Matzker system. The first step in their selection was to establish a midpoint cutoff frequency which would produce about equal distortion of both high and low frequency passed speech material. This midpoint frequency was set at 1700 Hz. Various frequency pass bands symmetrically arranged on either side of the 1700 Hz cutoff point were then evaluated by the investigators and the two systems used in the study were adopted.

Figure 1 illustrates the procedure for assembling the final study tape. Unfiltered speech was first passed through two band-pass filters in series, which determined the high and low frequency limits of the speech material according to the filtering system used. This signal was then split and sent through high and low pass filters on separate channels; the result was a high and low band-pass of the test material on either side of the 1700 Hz point. The two signals were balanced for maximum gain and minimum noise through a series of amplifiers and attenuators before passing through a switching system which alternated and combined the signals on the final tape recorder. The final step was to randomize the filtered test material and present it.

Insert Figure 1 about here

Filter System 1 presented frequencies from 425 to 1275 Hz (1-1/2 octaves) in one band and frequencies from 2550 to 6800 Hz (1-1/2 octaves) in the other band. The frequencies from 1275 to 2550 Hz (1 octave with center on 1700 Hz) were filtered out. Filter System 2 used frequencies from 637 to 1275 Hz and from 2550 to 5100 Hz, with the middle frequencies again omitted.

Procedure. Stimulus materials consisted of 10 words from the Thorndike (1929) list of the first thousand most frequently used words. The words chosen offered maximum distortion in each filter system and in the presentation of either high or low frequencies alone. Each word was presented in each of four conditions: high frequencies only, low frequencies only, high and low frequencies to separate ears (integration), and both frequencies to both ears (normal), so as to make a total list of 40 items separated by 6-sec. interstimulus intervals. The presentation order of conditions was reversed on the second of two trials. The words were presented through earphones at a comfortable level of loudness, though items at only the high or low frequencies suffered a slight loss of volume compared with the other conditions.

Ss were asked to repeat each word after hearing it through earphones. One correct practice trial using different words was required before the test began. After the practice trial and the first test trial, E stopped the tape recorder and said, "You're doing fine; now we'll do some more." E observed the child closely and recorded each attempt at repetition of the word. The final score was the number of stimuli incorrectly repeated under each condition.

Results and Discussion

Figure 2 summarizes the percentage of errors of all Ss for each word under each presentation condition across trials. The suitability of the stimuli is attested by the high percentage of errors for a word heard under either the high or low condition and the corresponding low percentage of errors for the word under the integration or normal condition. Only the word path could not be correctly repeated under the integration condition (IC) or normal binaural condition (NBC).

Insert Figure 2 about here

Comparison of the two filter-band systems indicated that the band-pass with frequencies from 637 to 1272 Hz and from 2550 to 5100 Hz produced higher mean errors under each condition (see Table 1). The stimulus words presented the same pattern of difficulty under both systems. Figure 3 presents the mean percentage of errors under various conditions for the two filter systems used in the pilot study.

Insert Table 1 about here

Insert Figure 3 about here

The mean error scores and standard deviations for each condition and for each trial for the normal and mentally retarded children is shown in Table 2, with accompanying means and standard deviations for errors under each condition for pooled trials. No attempt was made to use parametric statistical analysis on the data because Ss were not randomly selected. However, the data show no apparent significant differences between the two groups in the mean number of errors for each condition for pooled trials, but a difference trend is suggested in favor of the EMR Ss.

Insert Table 2 about here

Table 3 presents information on the integration condition and normal binaural condition for the same word. In Trial 1 the NBC condition preceded the IC one only twice; in Trial 2 it happened five times. The NBC-IC comparison could produce five different types of responses: (a) a word presented under both the IC and NBC was repeated correctly each time; (b) it was repeated incorrectly each time; (c) it was repeated incorrectly and differently each time; (d) it was correctly repeated under the IC condition and incorrectly under the NBC one; or (e) it was incorrectly repeated under the IC condition and correctly under the NBC one. Outcome (a) indicates no problems with hearing the material or integrating the frequencies. Outcome (b) may indicate Ss' difficulty in hearing the word under both conditions; it more likely reflects minor articulatory or dialectical variations recorded by E as S's response. For example, E heard the word week under both the integration and normal conditions as wink. Further evidence is the unchanging frequency of occurrence of this error over trials. With outcomes (c) and (d), the test is indeterminate. Only with outcome (e) has the test assessed auditory integration. An auditory integration score can be computed for each child in the following way: the number of responses in which the integration condition was incorrect and the normal correct divided by the number of times both were correct plus the number of times both were wrong but the same.

Insert Table 3 about here

For normal Ss the mean integration scores were .28 and .31 for Trials 1 and 2 respectively and for the EMR Ss the scores were .17 and .11. With S G. M.'s scores of 1.00 and 1.33 subtracted, the scores for the normal groups were .13 and .10.

The number of errors in each of the conditions decreased slightly from the first to the second trial. The learning effect appears greater for normal than for retarded Ss.

Table 4 presents the scores for each of the conditions and the integration score components by age groups. The EMRs were older and did better, although the one older normal boy also did very well. The test may involve some form of perceptual recognition of incomplete stimuli that is developmentally controlled.

Insert Table 4 about here

One child had integration scores high enough to discuss as a case study. G.M. was a nine-year-old with some reading difficulty and some indication of slow emotional development. He succeeded on the practice trial, but on Test Trial 1 he had only 3 out of a possible 40 words correct. On Trial 2 he missed 7 out of 10 words in each of the high and low conditions and had 5 integration and 5 normal words wrong. He gave both the integration and normal words correctly only three times. Twice he gave incorrect responses to both conditions, and once he gave the integration word correctly but the normal word incorrectly; four times he was unable to integrate. His integration ratio was therefore 4/3. Several explanations are possible for his poor performance: hearing difficulties; discomfort in the testing situation; neurological damage; inability to cope with an incomplete stimulus and form an auditory gestalt.

Several other children had equally high errors on the high and low conditions but only two had high errors on the integration and normal conditions. Both of them were mentally retarded, one with "soft neurological signs." Their scores were probably the result of dialect problems or experimenter errors, since both had high scores of the outcome (b) type.

In a pilot study of this sort it is more appropriate to focus on techniques than findings. Some evidence for an habituation or learning effect over trials, particularly in the integration and normal conditions, has already been mentioned. In subsequent investigations, at least two trials would seem to be advisable.

The high and low conditions were important in determining the usefulness of the stimulus words but of little value in assessing integration ability. The two conditions can probably be dropped in subsequent investigations--but only after equating the stimulus properties of the words selected. These two conditions were inadvertently presented at a slightly lower volume than were the integration and normal conditions. In the future all conditions should be presented at the same volume.

If the high and low conditions are eliminated, additional stimulus words can be presented in the integration and normal conditions. Such additional words should be tested under all four conditions with normal children; only those resulting in errors in the high and low condition but not in the integration and normal condition should be selected.

It is important to use the same words under both integration and normal conditions, so as to neutralize the misleading affects of variant articulation or dialect. The normal words should precede the integration words. In that way integration errors could not be attributable to faulty adaptation to the task.

Filter-band System 2 produced a desirably large number of errors under the high and low conditions, but it also produced more errors under the normal condition. Since the control condition should be almost errorless, filter-band system 1 is the one to use for future studies even though the number of integration errors may thereby be reduced.

The interstimulus interval of 6 sec. appeared too long for Ss. An interval of 4 or 5 sec. should be quite adequate.

The test is intended to detect possible brain injury. There is no reason to believe that more than one of the mentally retarded and possibly one of the normal boys had even minimal brain injury. It is imperative that the test now be tried on children with known neurological impairments.

References

Bocca, E., & Calearo, C. Central hearing processes. In J. Jerger (Ed.), *Modern developments in audiology*. New York: Academic Press, 1963. Pp. 367-371.

Harris, R. Central auditory functions in children. *Perceptual and Motor Skills*, 1963, *16*, 207-214.

Matzker, J. Two new methods for the assessment of central auditory functions in cases of brain disease. *Annals of Otology, Rhinology, and Laryngology*, 1958, *68*, 1185-1197.

Thorndike, E. L., & Lorge, I. *The teacher's word book of 30,000 words*. New York: Teachers College, 1929.

Figure Captions

Fig. 1. Schematic for filter system.

Fig. 2 Errors made on stimulus words as a percentage of total times the word was presented by type of condition.

Fig. 3. Mean percentage of errors for four conditions for the two filter systems.

Table 1

Mean Error Scores and Standard Deviations for Each Condition by Filter System

Condition	Filter System			
	One		Two	
	Mean	Standard Deviation	Mean	Standard Deviation
High	15.3	1.9	16.5	1.6
Low	11.5	4.1	12.8	3.1
Integration (IC)	6.8	3.9	7.2	3.7
Normal (NBC)	6.2	2.5	8.2	3.2

Table 2

Mean Error Scores and Standard Deviations for Each Condition by Type of Child and Number of Trials

Condition	Type of Child and Number of Trials											
	Filter System One				Filter System Two				Filter Systems (Both)			
	EMR		Normal		EMR		Normal		EMR		Normal	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
High	8.2	1.2	8.8	1.2	7.2	1.2	7.7	0.8	15.3	2.3	16.5	1.0
Low	6.0	2.2	6.2	1.6	5.5	2.4	6.7	1.6	11.5	4.5	12.8	2.4
Integration (IC)	3.8	1.5	4.0	2.5	3.3	2.7	2.8	1.3	7.2	3.9	6.8	3.5
Normal (NBC)	4.0	1.7	5.2	2.5	2.7	2.1	2.5	1.3	6.7	4.2	7.7	1.2

Table 3

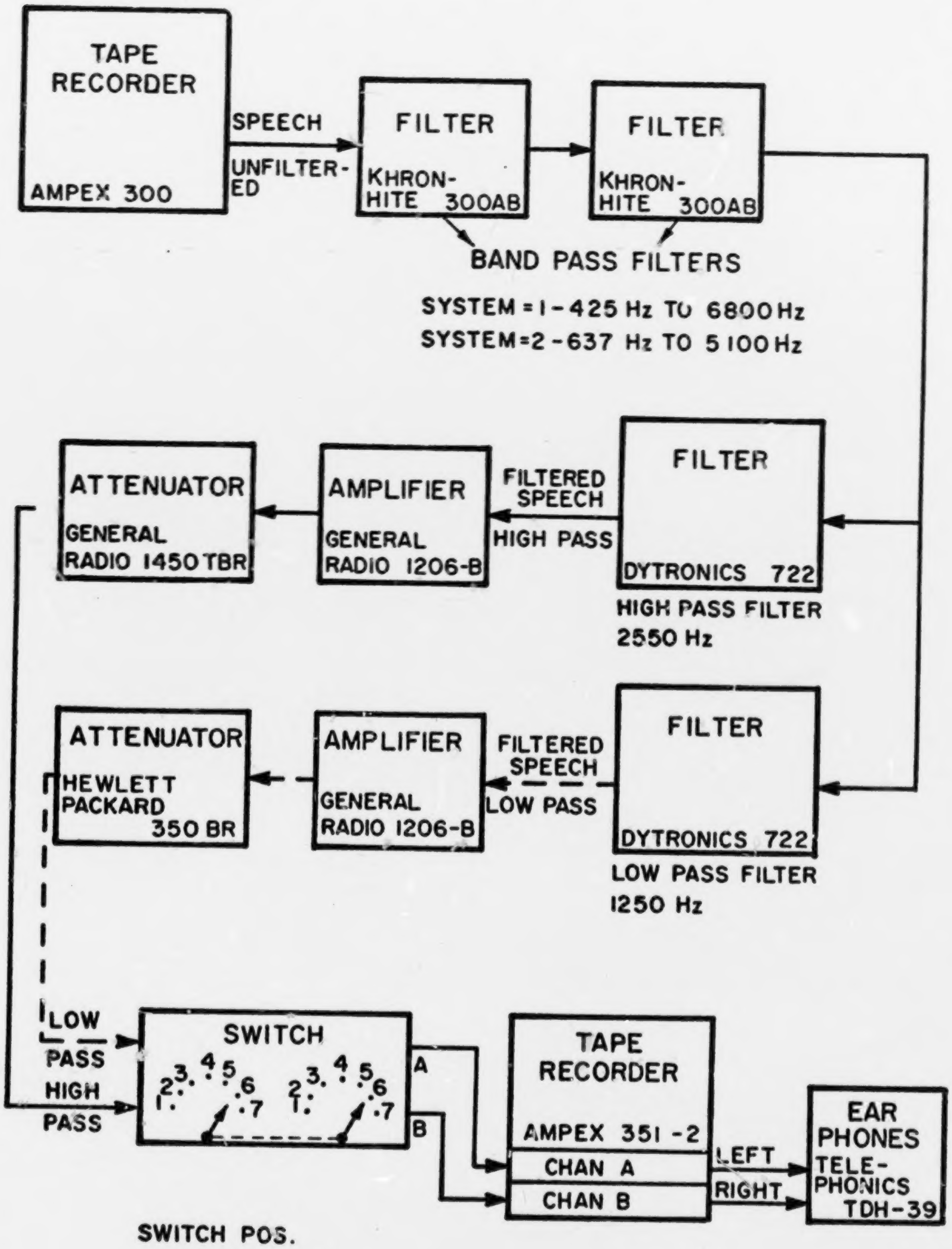
Per Cent Distribution of Error Scores on Integration--Normal Patterns by Type of Child and Trial

Integration Normal Pattern	Type of Child and Trial					
	Trial One		Trial Two		Total Trials	
	EMR	Normal	EMR	Normal	EMR	Normal
Both Right	50%	40%	65%	65%	57%	52%
Both Wrong Samd Word	12	13	12	7	12	10
Both Wrong Different Words	15	17	10	10	13	14
Integration Right Normal Wrong	13	22	7	5	10	13
Integration Wrong Normal Right	10	8	6	13	8	11
Total	100%	100%	100%	100%	100%	100%

Table 4

Mean Error Scores for Each Age Group by Type of Condition

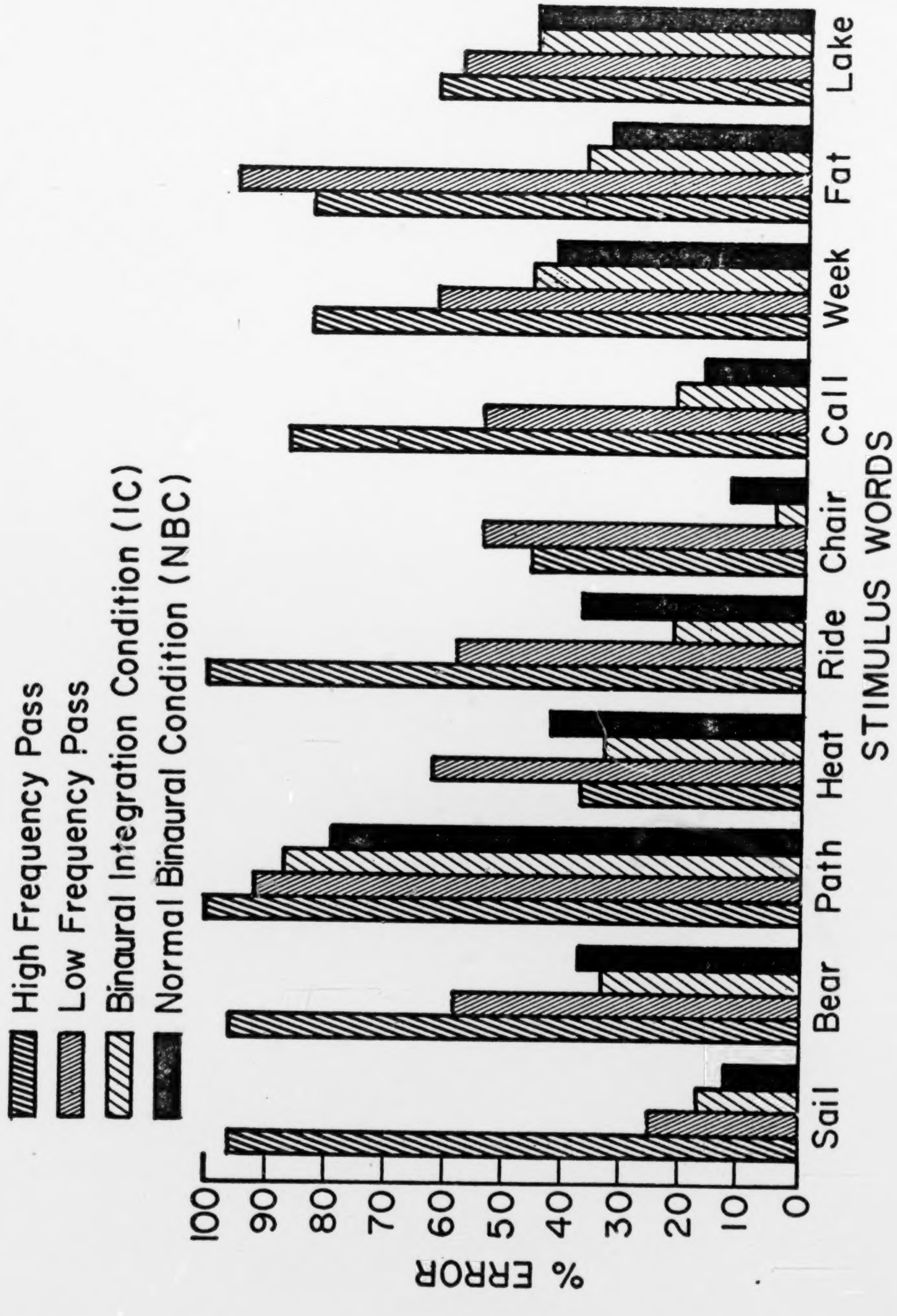
Age	N	Type	Type of Condition			
			High	Low	Integration	Normal
7	4	N	17	12	5	7
8	2	EMR	16	12	10	8
9	1	N	17	16	14	14
10	1	EMR	14	14	7	7
11	2	EMR	17	12	8	7
12	1	N	15	12	6	5
13	1	EMR	13	7	3	2


TAPE RECORDER
AMPEX 300
SPEECH
UNFILTERED
FILTER
KHRON-HITE 300AB
FILTER
KHRON-HITE 300AB
BAND PASS FILTERS
SYSTEM = 1 - 425 Hz TO 6800 Hz
SYSTEM = 2 - 637 Hz TO 5100 Hz
ATTENUATOR
GENERAL RADIO 1450 TBR
AMPLIFIER
GENERAL RADIO 1206-B
FILTERED SPEECH
HIGH PASS
FILTER
DYTRONICS 722
HIGH PASS FILTER 2550 Hz
ATTENUATOR
HEWLETT PACKARD 350 BR
AMPLIFIER
GENERAL RADIO 1206-B
FILTERED SPEECH
LOW PASS
FILTER
DYTRONICS 722
LOW PASS FILTER 1250 Hz
LOW PASS
HIGH PASS
SWITCH
1. 2. 3. 4 5 6 7
1. 2. 3. 4 5 6 7
A
B
TAPE RECORDER
AMPEX 351 -2
CHAN A
CHAN B
LEFT
RIGHT
EAR PHONES
TELE-PHONICS TDH-39

SWITCH POS.

1. HIGH TO CHAN. A
2. HIGH TO CHAN. B
3. HIGH TO CHAN. A AND LOW TO CHAN. B
4. LOW TO CHAN. B
5. LOW TO CHAN. A
6. HIGH TO CHAN. B AND LOW TO CHAN. A
7. HIGH & LOW TO CHAN. A AND HIGH & LOW TO CHAN. B

Figure 1



▨ High Frequency Pass
▨ Low Frequency Pass
▨ Binaural Integration Condition (IC)
■ Normal Binaural Condition (NBC)
% ERROR
100
90
80
70
60
50
40
30
20
10
0
Sail
Bear
Path
Heat
Ride
Chair
Call
Week
Fat
Lake
STIMULUS WORDS

Figure 2

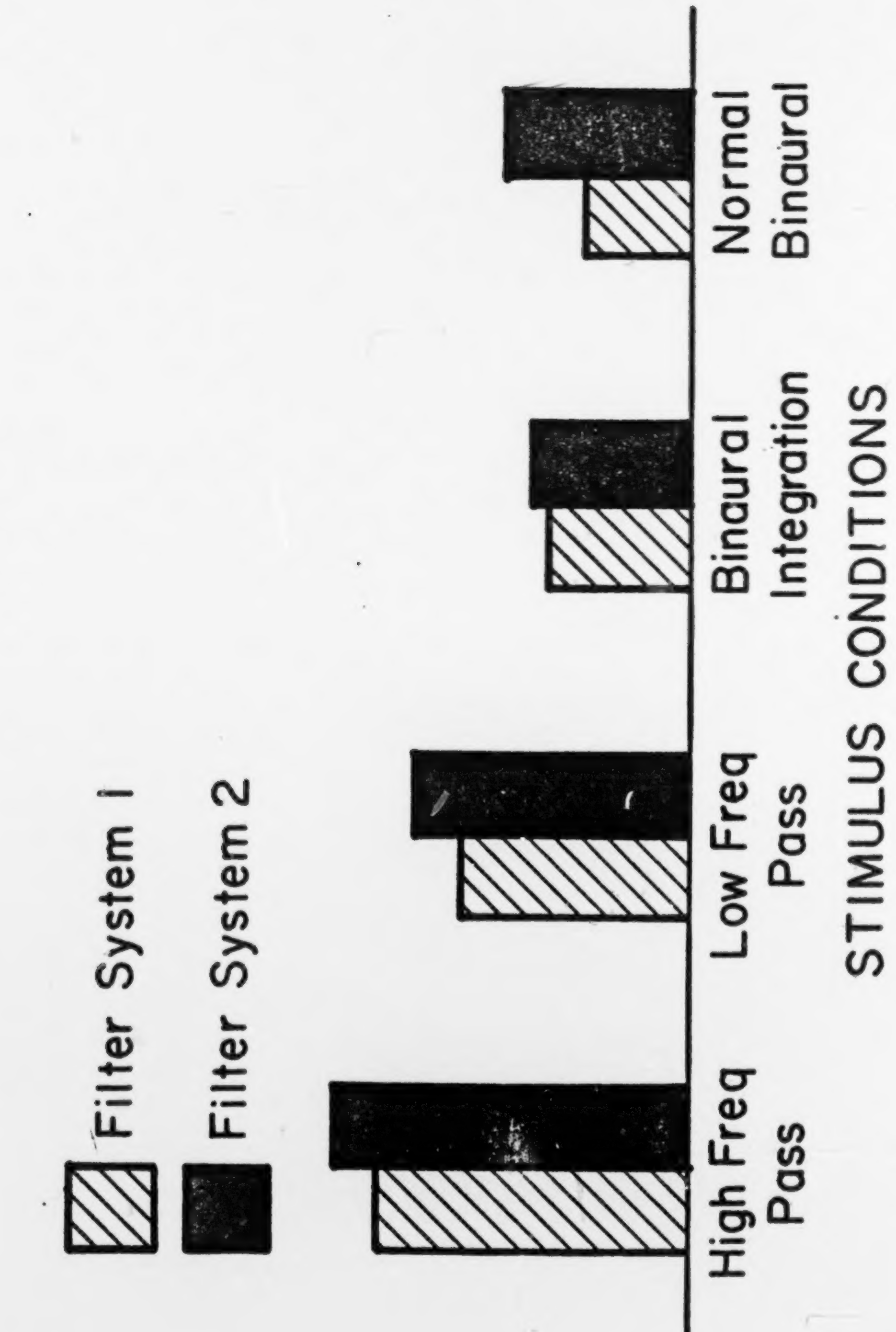

Filter System 1
Filter System 2
X̄ % ERRORS
80
70
60
50
40
30
20
10
High Freq Pass
Low Freq Pass
Binaural Integration
Normal Binaural
STIMULUS CONDITIONS

Figure 3

Chapter VI

Project CATTS I

A COMPUTER-ASSISTED TEACHER TRAINING SYSTEM

Melvyn I. Semmel

Center for Research on Language and Language Behavior
and
School of Education
The University of Michigan

Early stages in the development of a computer-assisted teacher training system (CATTS) for special educators are reviewed in five sections. Part I discusses the problem of existing systems of classroom analysis--i.e., delayed feedback and the tedium of coding, summarizing, and analyzing verbal interaction data. Part II discusses the philosophical rationale and cybernetic model guiding the development of CATTS. The three components of the system are outlined and the initial computer prototype program is discussed. Part III offers a brief overview of the initial pilot demonstration study with CATTS. Photographs illustrate the different facets of the system in operation and the cathode ray tube (CRT) cumulative functions used as feedback information to the instructor in the pilot demonstration. Part IV presents a description and preliminary evaluation of four visual display programs developed for CATTS. Part V consists of a preliminary review of the literature on the problem of training special educators, on existing systems for the analysis of classroom behavior, and on the role of feedback variables in teacher training.

Although teacher training programs generally lack specificity about their behavioral objectives and procedures, there seems to be an agreed hierarchy of emphasis on what is deemed important in the training of teachers. Such variables as amount and nature of practicum experiences figure prominently--probably because direct contact is thought more valuable to students than vicarious lectures and discussions about teaching. However, simply providing opportunity to observe in an appropriate practicum setting does not assure the growth of trainees' teaching skill any more than does lecture or discussion in a university methods course.

Programs differ considerably in the nature and amount of structure offered to university trainees in practicum environments. Several models are currently being utilized. At one extreme the trainee is simply assigned to a "master" teacher, who assumes responsibility for training the apprentice (e.g., Hielson, 1965; Olson & Hahn, 1964), usually to teach as he does, but often to perform special missions like working with specific children and performing minor non-teaching tasks. At the other extreme is found systematic university supervision of trainees in situ, followed by a supervisory conference during which the supervisor's impressions are transmitted to the trainee, who is expected to modify his behavior accordingly in a subsequent lesson (e.g., Anderson & Little, 1968).

The latter model appears to be clearly superior to the former as a means of achieving the goals of a university training program. However, closer analysis of the supervisory process reveals that (a) the trainee often has little information about the specific behaviors deemed important to the supervisor, (b) the supervisor often has no systematic technique for focusing on relevant teaching behaviors (he often relies on vague ad hoc impressions), and (c) there is frequently little relationship between one supervisory conference and another.

As a perusal of the literature will show, very little attention, if any, has been given to developing and demonstrating methods of teacher training capable of eliminating the defects just described. Clearly there is a need for observational systems which focus on the variables deemed most important to the teacher training program so as to produce teachers who act in accordance with the philosophical orientations of the programs that train them. The need exists quite independently of any question about the validity of such orientations. Training programs must fully specify what they posit as the most relevant behavioral variables in teaching and then develop procedures to observe and modify these behaviors systematically in the practicum classroom setting. To do so obviously calls for the development of systematic classroom observation and feedback systems in teacher education.

Drawbacks of Existing Systems of Teacher-Pupil Interaction

Whereas the field of Special Education has produced relatively little research on systems of observation of classroom teacher-pupil interaction variables, several categorical systems have been developed and tested by educational psychologists interested primarily in regular classroom interactions. These systems may be envisaged in terms of two related characteristics:

(a) the nature and type of content categorized, and (b) the method used to make observations, code behavior, summarize and analyze data, and feed information back to the trainee.

Investigators have attempted to classify verbal interaction of teachers and pupils into different content categories. For example, Flanders (1964) at the University of Michigan has developed a system based on categories of teacher and pupil talk; Bellack's (1966) extensive system focuses on the nature of teacher-pupil interacting strategies in the classroom, while Gallagher's (1965) focuses on cognitive behaviors modeled after Guilford's paradigm for the structure of the intellect. Still other categorical systems have been presented which isolate what is thought to be "relevant" teacher-pupil behavior (see Medley & Mitzel, 1963).

The heterogeneity of the content categorized by these systems may be more apparent than real. If the criteria used to assign behaviors to categories are closely examined and stripped of the technical jargon peculiar to each system, then they may overlap more than at first appears. In any case, the intensive analysis of existing categorical systems should yield valuable information on what is considered relevant teaching behavior by a large number of researchers from different fields of interest.

As regards the second feature of existing observation systems, a remarkable commonality is found in the methods they use to collect, analyze, and feed back information to teacher trainees. Apparently all the systems are descriptive, that is, they are designed and used to describe or summarize the classroom interaction well after it has taken place. In other words, these approaches are essentially retrospective and have no effect on the particular teacher-pupil interaction being observed at any given moment.

The procedures used in applying these systems in training situations are essentially the same. The standard paradigm is displayed in Figure 1. An observer sits in the classroom and records the on-going interactions in a prescribed code; or the verbal interaction in the classroom may be recorded on magnetic tape and later transcribed and coded to conform to the particular system favored.

In more advanced methods like the one developed by Flanders (1964), observations are coded at regular intervals and the entries are subsequently summarized by the observer either in a matrix reflecting the sum of double entry Markovian chains (e.g., the number of items of behavior category X that followed category Y) or in terms of simple proportions of the behavior categories represented in the total corpus of verbal material coded. In any event, once the coded data are summarized and analyzed, the observer and the teacher analyze the summarized information and establish goals for subsequent performance (see Figure 1).

Insert Figure 1 About Here

It can readily be seen that the systems just described are subject to several limitations: the extensive encoding and decoding entails considerable time and expense, and necessitates delay of feedback of relevant information to the trainee. To be sure, the new microteaching training technique utilizing closed circuit television (Allen, 1967) somewhat reduces these problems; but this technique does not appear to lend itself to immediate real-time feedback in the classroom nor to permit a systematic analysis, storage, and retrieval procedure during teacher-training sessions.

Project CATTS seeks to correct such limitations by introducing the following capabilities into the study of teacher-pupil interaction: (a) instantaneous feedback of relevant information to the teacher, while he is teaching, through a meaningful display located in the classroom; (b) the reduction of the tedium associated with coding, summarizing, and analyzing teacher-pupil interactions, and at the same time the provision for a permanent record of coded behavior; and (c) rapid storage and retrieval of pupil-teacher interaction variables for each trainee in the program.

Project CATTS' goal is, then, to develop a versatile and economical computer-based teacher training system with the capabilities for providing immediate visual feedback of data relevant to teacher-pupil interaction in a classroom setting.

When CATTS is operational it should be applicable to any training situation in which:

1. the interaction of teachers and pupils is to be summarized or analyzed in terms of any system composed of behavior categories;
2. the summarized and analyzed data are to be fed back immediately to the teacher in the classroom through a meaningful display;
3. the behavior, once coded, summarized and analyzed by computer, is to be instantaneously stored for quick retrieval later.

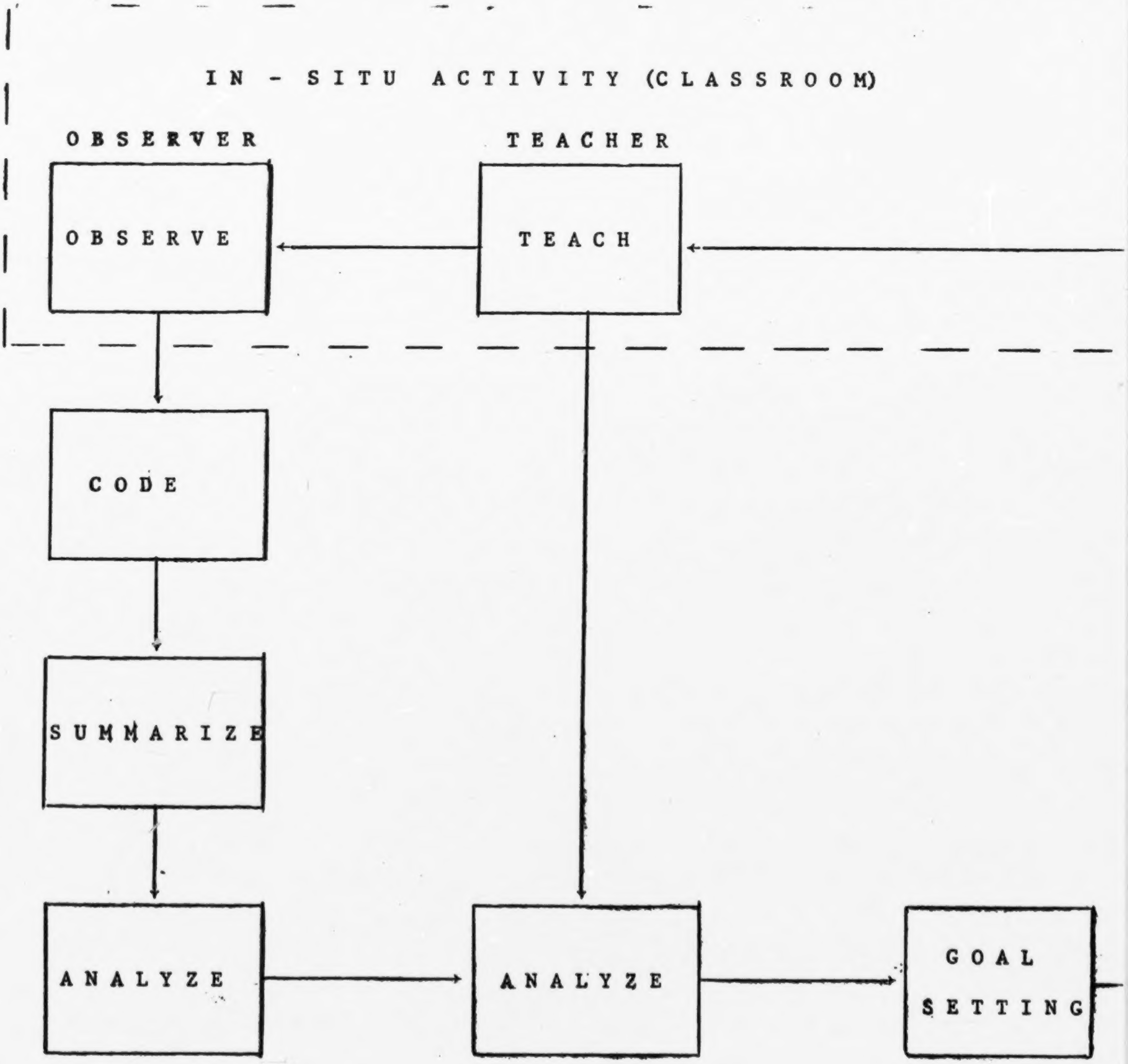

IN - SITU ACTIVITY (CLASSROOM)
OBSERVER
TEACHER
OBSERVE
TEACH
CODE
SUMMARIZE
ANALYZE
ANALYZE
GOAL SETTING

Figure 1. Traditional paradigm for teacher training techniques utilizing classroom interaction analysis techniques.

Work on CATTS is presently directed toward practical application in university Special Education teacher training programs, in-service continuing education programs for special teachers in the schools, and all programs that train personnel to direct and lead groups of children or adults.

Earlier work on the analysis of pupil-teacher interaction in the classroom motivated the interest of the investigator and his associates at the Center for Research on Language and Language Behavior (CRLLB) in the problem of the systematic analysis and modification of teacher behavior. Two preliminary studies made use of the Flanders' technique of interaction analysis to determine what qualitative differences in verbal behavior exist among teachers who teach different types of children. Semmel, Herzog, Kreider, and Charves (1966) and Semmel, Herzog, and Jorgenson (1965) found interesting differences between teacher-pupil interaction in classes for educable mentally retarded (EMR) pupils as compared with classes for trainable mentally retarded (TMR) and normal pupils. Teaching patterns in classes for TMR pupils varied with teacher attitude scores on the Minnesota Teacher Attitude Inventory (Semmel, Herzog, Kreider, & Charves, 1966).

Semmel and his graduate students subsequently undertook an extensive demonstration-research project designed to determine the effects of feedback on teacher trainees who were systematically observed and evaluated during 15 half-hour practicum teaching lessons. Trainees were taught to use the modified version of the Bellack system of analysis to evaluate their performance on magnetic tape recordings of the sequence of lessons which they taught; supervisors were trained to feed back corrective information to individual trainees and to suggest specific teaching styles according to the amount and quality of teacher talk in the classroom. This pilot work, which is still being evaluated, served as one of the precipitants for the development of CATTS.

It rapidly became evident that the only vehicle with the potential for satisfying the requirement of immediate feedback to trainees in the classroom while eliminating the tedium of coding, summarizing, and analyzing observational data was a computer-assisted system. Progress toward developing CATTS has been the work of a team of researchers from CRLLB, presently comprising the principal investigator (Dr. Semmel), four advanced graduate assistants specializing in the doctoral program in Mental Retardation with an emphasis on Teacher-Training at the University of Michigan, a computer programer and systems analyst (T. Rand), and an electronics specialist (J. Olson).

The team set itself three preliminary goals: (a) to review literature relevant to CATTS, (b) to develop specifications for the hard and software for CATTS, and (c) to simulate a prototype CATTS with the help of existing CRLLB facilities and equipment. The present report traces the progress made toward achieving these preliminary objectives.

Project CATTS II

DESCRIPTION OF PROTOTYPE CATTS

Melvyn I. Semmel

In their work, Cybernetic Principles of Learning and Educational Design, published in 1966, Karl and Margaret Smith espouse an approach to human learning based essentially on the findings of early researchers in human engineering. The Smiths argue convincingly for a cybernetic interpretation of behavior--one quite different from conventional theories of learning. The cybernetic approach is a "general theory of behavior organization which...views the individual as a feedback system which generates its own activities in order to detect and control specific stimulus characteristics of the environment." CATTS is conceptualized as a closed-loop cybernetic system characterized by immediate feedback of relevant teacher-pupil interaction data to the teacher so that modification of behavior can be realized through regulatory teaching moves in accordance with a pre-determined strategy so as to create the desired classroom environment. The major goal guiding the development of CATTS is to furnish the trainee with relevant information concerning the state of classroom verbal interaction so that regulatory behavior can be initiated toward establishing a desired classroom learning environment.

The Components of CATTS Prototype I

Figures 2 and 3 present the schematic diagram of the closed-loop prototype CATTS developed by the CRLLB research team. The components of the system are depicted as three interdependent stations: I. Teaching Station; II. Observation-Coding Station; and III. Analysis Encoding Station.

Insert Figures 2 & 3 About Here

I. Teaching Station. This component consists of a teacher or leader and a class of pupils (or other type of group) with the cathode ray tube (CRT) of an oscilloscope clearly visible to the teacher.

II. Observation-Coding Station. This component consists of an observer seated in front of a one-way-vision mirror located between Stations I and II. The observer operates a coding device consisting at present of eight or ten buttons (e.g., four teacher behavior buttons and four pupil behavior buttons). The observer uses any one of several coding systems to press the appropriate buttons corresponding to categories of teacher-pupil behavior within the system

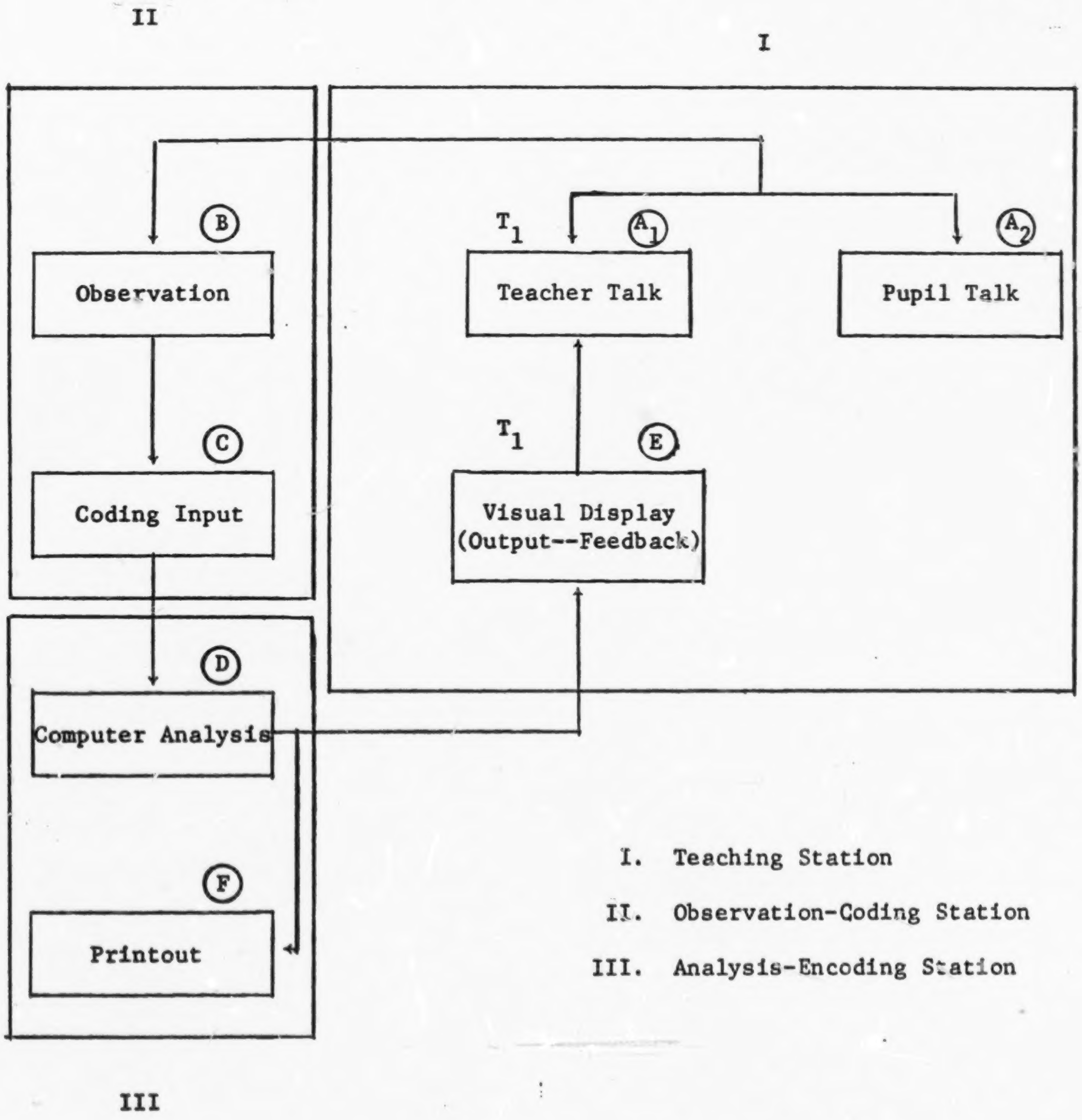

II
I
B
T1
A1
A2
Observation
Teacher Talk
Pupil Talk
C
T1
E
Coding Input
Visual Display (Output--Feedback)
D
Computer Analysis
F
Printout
I. Teaching Station
II. Observation-Coding Station
III. Analysis-Encoding Station
III

Figure 2. Schematic flow chart of CATT system.

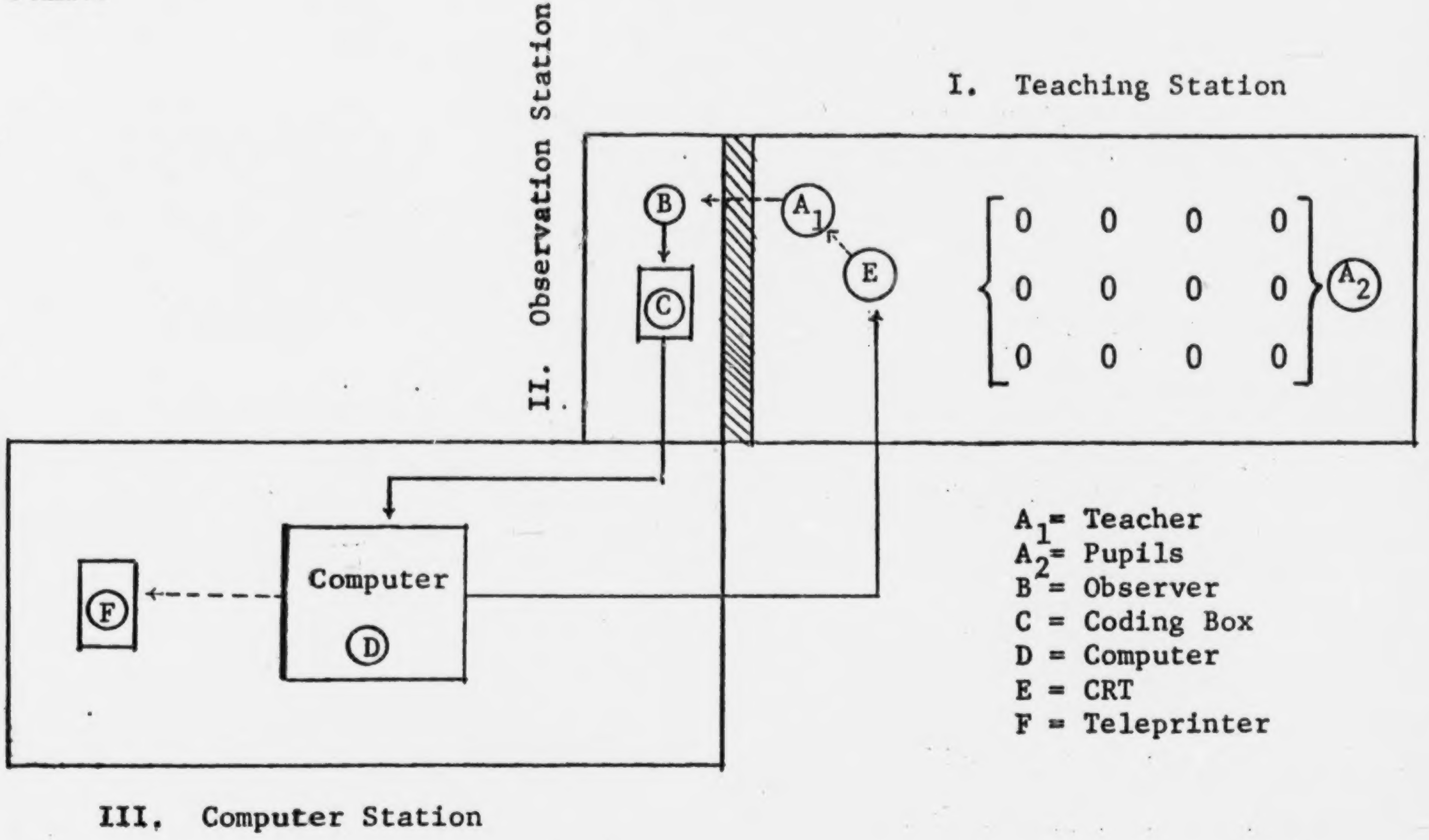

I. Teaching Station
II. Observation Station
III. Computer Station
B
C
A1
E
A2
0 0 0 0
0 0 0 0
0 0 0 0
Computer
D
F
A1 = Teacher
A2 = Pupils
B = Observer
C = Coding Box
D = Computer
E = CRT
F = Teleprinter

Figure 3. Schematic diagram of present physical arrangement of CATTS stations.

of behavior analysis being used. These coded signals are relayed to the Analysis-Encoding Station.

III. Analysis-Encoding Station. This component consists at present of a PDP-4 digital computer and a hard-copy print-out source. Signals received from Station II are processed instantaneously by the computer in accordance with a predetermined program. Output consists of a visual display, on the CRT at Station I, of the behavior under observation--cumulative percentage curves, for example--and a permanent hard-copy computer print-out at Station III.

The translation of the closed-loop cybernetic principle is thus achieved by using an observer-coder as the interface between the teacher and the computer. Behavior observed in Station I is coded immediately and relayed to the computer, which carries out the prescribed analysis and feeds the results directly back to the teacher in visual form. It is hypothesized that the teacher can monitor his performance through CATTS and regulate his behavior to conform to specific behavioral objectives. It remains to be explored what use teachers can make of such feedback. We believe that significant modifications in teaching behaviors can be achieved through CATTS.

A time-line feedback display for providing visual information to trainees was developed for the Prototype CATTS. The system and the feedback program were piloted in a demonstration study with an instructor of an introductory course in Educational Psychology who volunteered to conduct his class in the CRLLB laboratory.

Pilot Time-Line Feedback Program

The core of the apparatus is a small, general-purpose digital computer (Digital Equipment Corporation's PDP-4) with 16 multiplexed analog-to-digital inputs, 3 digital-to-analog outputs, and an 18-relay buffer. Eight push-button switches and a voltage source were connected to eight of the A-D inputs (see Figure 4) and one of the computer's relays was connected to a light in each of the push buttons. Two D-A outputs were connected to an x-y oscilloscope (Tektronix type 503) for horizontal and vertical control. Finally, an oscilloscope camera (Tektronix C-12) was available for taking pictures of the scope display. With this configuration of equipment the computer could sense buttons pressed by the observer, could signal the observer by turning on the lights, and could place a display on the oscilloscope.

The computer program, written in PDP-4 Assembly Language, consists of an executive routine that services three subroutines: (a) an A-D routine that looks for buttons being pressed and records them; (b) a display routine that plots the current output data onto the oscilloscope screen; and (c) a print-out routine that produces a hard copy of the output data on the computer's teleprinter. The executive routine also handles various timing and counting operations.

When the system is in operation and the program started, every button press increments one of eight counters (in the computer's memory), thereby keeping a running total of how many times each button has been pressed since the beginning of the current 15-min. period. Every 10 sec., two computations are performed: (a) the number of times that buttons 1 and 2 have been pressed is divided by the current total for buttons 1 through 4, and this quotient is multiplied by 100 to create a percentage; (b) the corresponding operation is performed to determine the percentage of presses of the first four buttons out of all eight.

These two percentage figures are added to storage vectors containing all such computed numbers since the start of the experiment. In addition, these numbers (and the time lapse since the start of the session) are printed on the computer's teleprinter every 10 sec. (printing a line takes roughly 4 sec.). The storage vectors containing the accumulated percentages are made available to the display routine, which continually plots as many values on the oscilloscope as the vectors may contain.

In addition to this ongoing process, the contents of all eight button counters are stored once a minute in another vector to be printed at the end of the session.

Whenever a 3-sec. interval of time elapses without button presses, the computer turns on the observer's button lights. These lights are extinguished when a button is pressed (see Figure 4).

Insert Figure 4 About Here

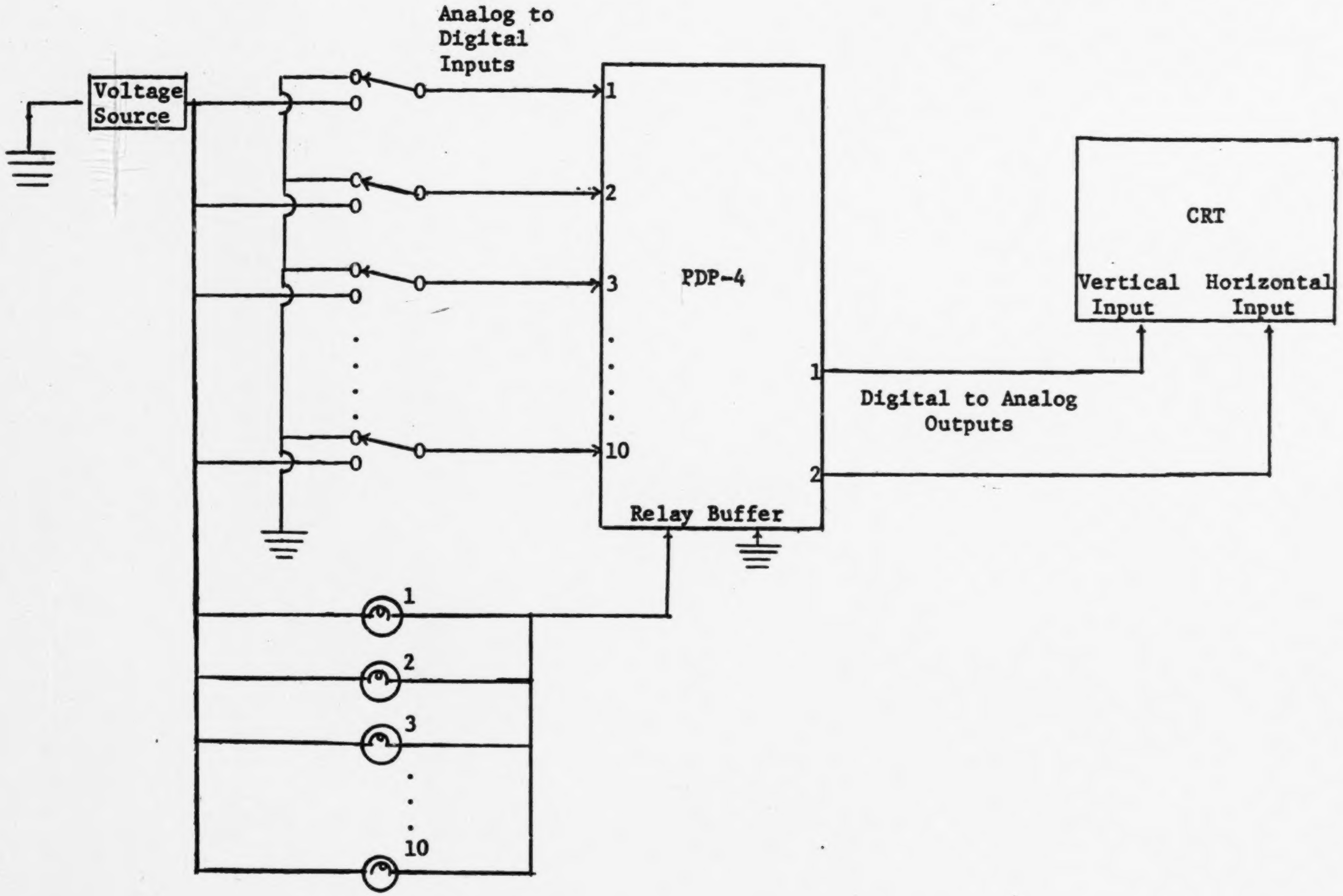

Analog to Digital Inputs
Voltage Source
PDP-4
Relay Buffer
1
2
3
10
Digital to Analog Outputs
CRT
Vertical Input
Horizontal Input
1
2
3
10

Figure 4. Pilot time-line feedback program--schematic diagram of hardware components for phototype CATTS.

Project CATTS III

INITIAL PILOT DEMONSTRATION STUDY USING CATTS

Melvyn I. Semmel, J. Kreider, J. Schmitt, H. Van Every, and P. Weaver

Procedure

An attempt was made to explore the feasibility of CATTS as a teacher-training device. The initial study was designed to uncover unanticipated problems with the system and to elicit subjective reactions of participants in the pilot demonstration. No attempt was made to evaluate the effects of the system on teacher behavior.

The instructor participating in the initial pilot demonstration study with CATTS was a graduate teaching fellow leading an educational psychology class for undergraduates at the University of Michigan. The class, composed of nine undergraduate students at the junior level, was led by the instructor in an informal group sensitivity training session.

Bellack's system of "Content Analysis" was used to record the verbal interaction which took place between the instructor and students in the class. Bellack defines four basic types of pedagogical moves to describe such interactions: (1) structuring, (2) soliciting, (3) responding, and (4) reacting.

Two of the pedagogical moves, structuring and soliciting, are described by Bellack as initiatory moves. Structuring moves are defined as "setting the context for subsequent behavior by (a) launching or halting excluding interactions between teacher and pupils, and (b) indicating the nature of the interaction in terms of the dimensions time, agent, activity, topic and cognitive process, regulations, reasons, and instructional aids" (Bellack, Kliebard, Hyman, & Smith, 1966, pp. 16-17). Soliciting moves are described as "intended to elicit (a) an active verbal response on the part of persons addressed; (b) a cognitive response, e.g., encouraging persons addressed to attend to something; or (c) a physical response" (Bellack et al., 1966, p. 18).

Two of the pedagogical moves, responding and reacting, are presented by Bellack as reflexive moves. "Responding moves bear a reciprocal relationship to soliciting moves and occur only in relation to them. Their pedagogical function is to fulfill the expectation of soliciting moves and is, therefore, reflexive in nature" (Bellack et al., 1966, p. 18). Reacting moves are "occasioned by structuring, soliciting, responding, or a prior reacting move, but are not directly elicited by them. Pedagogically, these moves serve to modify (by clarifying, synthesizing, or expanding) and/or to rate (positively or negatively) what was said in the move(s) that occasioned them" (Bellack et al., 1966, pp. 18-19).

CATTS Program

A panel of eight buttons coded to accommodate Bellack's system was used with prototype CATTS. The four buttons on the upper half of the coding panel represented teacher moves in the class. One button was assigned to each of Bellack's four pedagogical move categories. The buttons on the lower half of the coding panel were used for student moves in the class with each button assigned to one of the four pupil move categories.

The coded information from the panel button presses was fed to a PDP-4 computer programmed to operate a CRT display in the classroom. Two functions appeared on the feedback display: the upper function plotted the percentage of teacher moves within the total moves made in the class; the lower function plotted the percentage of reflexive teacher moves within the total teacher moves. Both the upper and the lower functions were divided into two 15-min. segments and summed the cumulative percentage over time for each of the two 15-min. periods. Thus, the CRT display presented feedback information to the instructor across a 30-min. period in two 15-min. segments.

The demonstration consisted of three time periods--two 15-min. segments per period. Baseline behavior was obtained during Period I (first 30 mins.) on the percentage of teacher moves within the total number of moves in the classroom, and on the percentage of reflexive moves within the total teacher moves. The teacher received no information from the scope during Period I.

Following the first period, the teacher and experimenters met to discuss the previous session. The Bellack system was explained to the teacher, who was also informed of his performance on the two variables tracked. The cumulative functions derived from Period I were reviewed (see Figure 11, Photo A).

The teacher was directed to decrease his reflexive moves. He was informed that the cumulative function of such moves could be observed on the lower portion of the CRT. He then re-entered the classroom and proceeded to teach (Period II) with the scope visible in the classroom.

At the termination of Period II, the teacher again reviewed photographs of his performance during the two periods. He was asked to maintain the achieved level of reflexive moves during Period III.

Segment 2 of the third period was discontinued after 3 min. because several members of the class had to leave. Hence, Period III yielded data for 18 min. as compared to 30 min. each for the first and second periods.

Figures 5 through 11 present photographs of the different facets of the initial demonstration with the prototype CATTS. Figure 11 presents the cumulative time-line functions for the three periods of the demonstration.

Insert Figures 5 - 11 About Here

Computer Printout

The computer was programmed to print out data sheets containing both percentage and frequency information for consecutive 10-sec. intervals. Here follows a sample of the percentage data in the printout for 1 min.

```
1M*     10s*    80     25
1M      20s     80     18
1M      30s     79     21
1M      40s     73     31
1M      50s     72     33
2M       00s     66     33
```

*M indicates min. - s indicates sec.

During the time interval from 1 min. to 1 min. 10 sec., the percentage of teacher talk to total talk was 80%; the percentage of teacher reflexive moves to total teacher moves was 25%. At 2 min. 0 sec. the cumulative percentage of teacher talk to total talk was 66% and the cumulative percentage of teacher reflexive moves to total teacher moves was 33%. The percentages are calculated every 10 sec. for the total amount of information fed into the computer since the start of the period. At the end of every minute the cumulative percentages are offset on the printout to enable quick observation.

The following is a sample of the frequency data from the computer printout for one 15-min. interval:

```
Button #     15M     Total

   1          14     (Teacher responding move)
   2          47     (Teacher reacting move)
   3          32     (Teacher structuring move)
   4          14     (Teacher soliciting move)
   5          31     (Pupil responding move)
   6          28     (Pupil reacting move)
   7          43     (Pupil structuring move)
   8          13     (Pupil soliciting move)
             222     Total moves during 15-min. interval
```

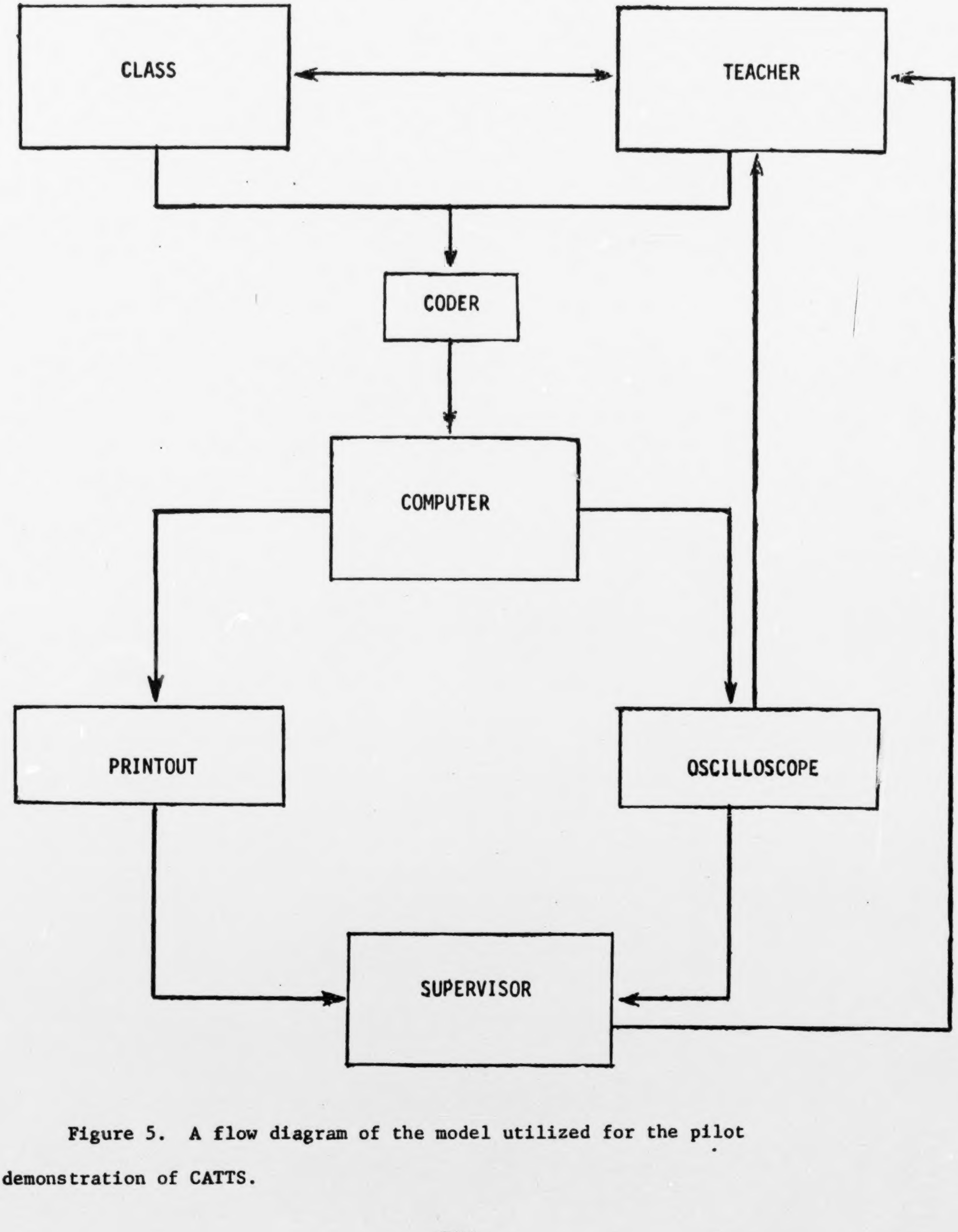

CLASS
TEACHER
CODER
COMPUTER
PRINTOUT
OSCILLOSCOPE
SUPERVISOR

Figure 5. A flow diagram of the model utilized for the pilot demonstration of CATTS.

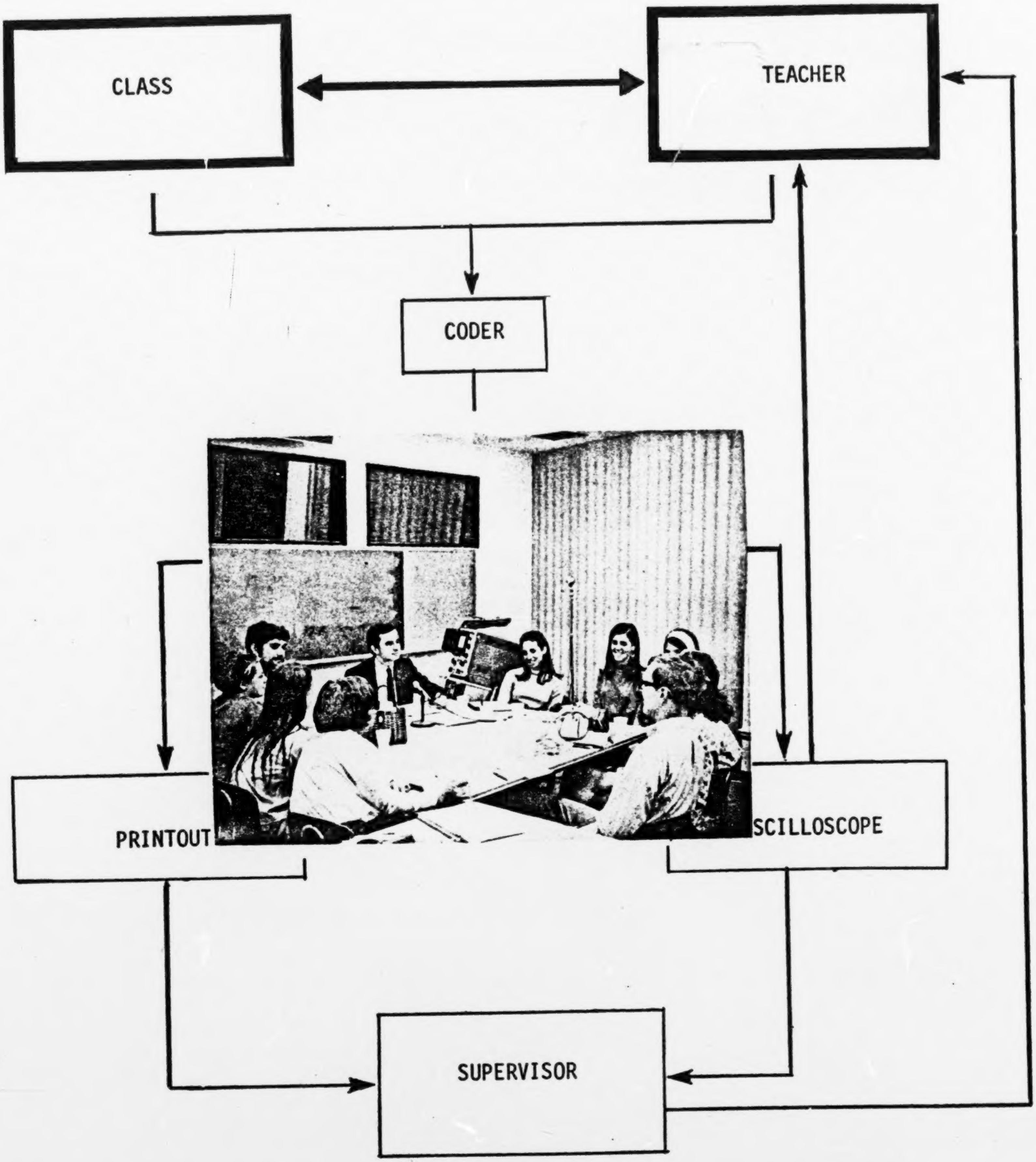

CLASS
TEACHER
CODER
PRINTOUT
SCILLOSCOPE
SUPERVISOR

Figure 6. Station I of the CATTS system (Teaching Station) showing the instructor and students with the CRT feedback display. No visual feedback was given during Period I of the demonstration study.

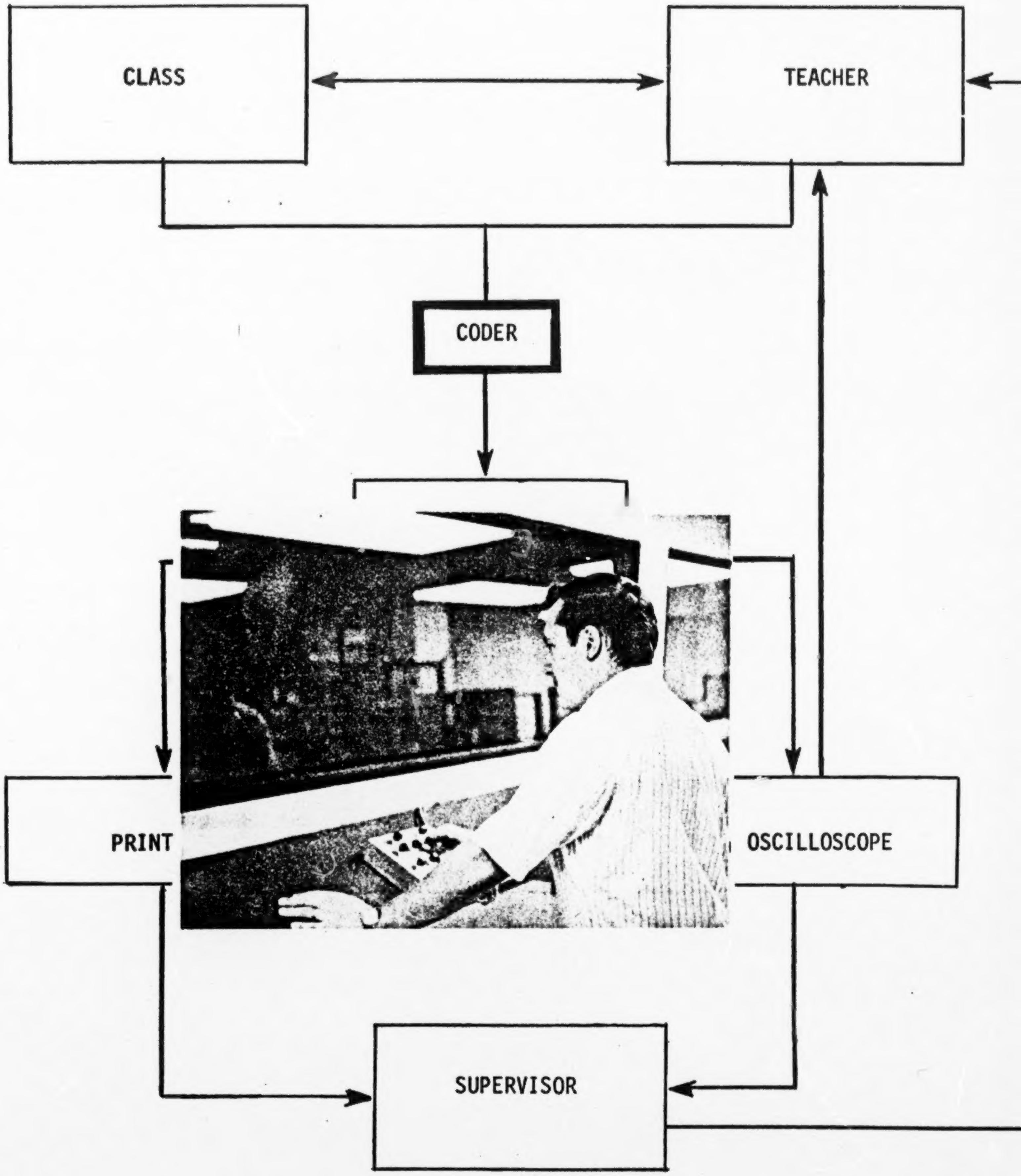

CLASS
TEACHER
CODER
PRINT
OSCILLOSCOPE
SUPERVISOR

Figure 7. Station II (Observation-Coding Station) showing the observ

coder and the one-way-vision mirror.

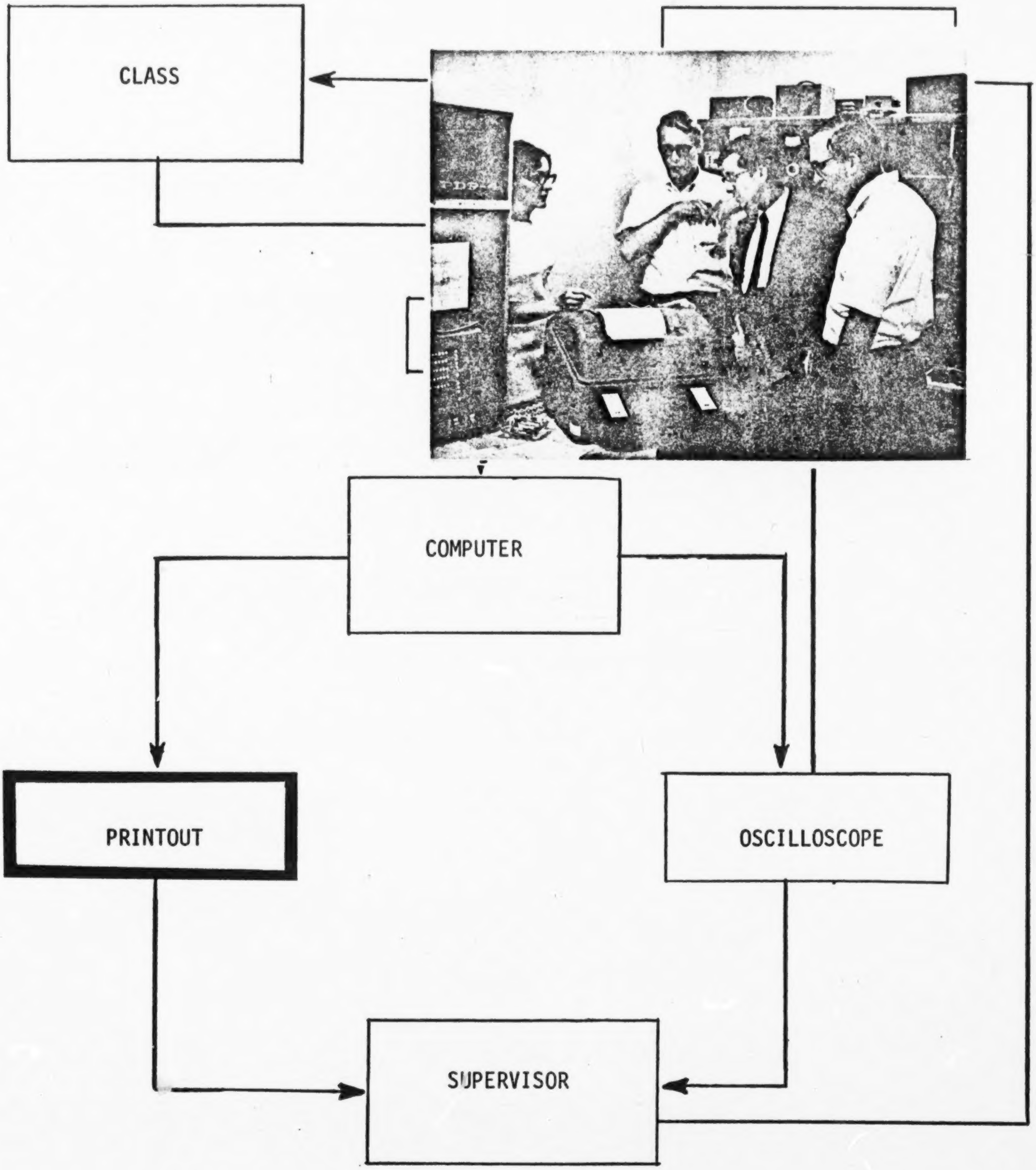

CLASS
COMPUTER
PRINTOUT
OSCILLOSCOPE
SUPERVISOR

Figure 8. Station II-III (Analysis-Encoding Station) showing the PDP-4 computer and the high speed teleprinter.

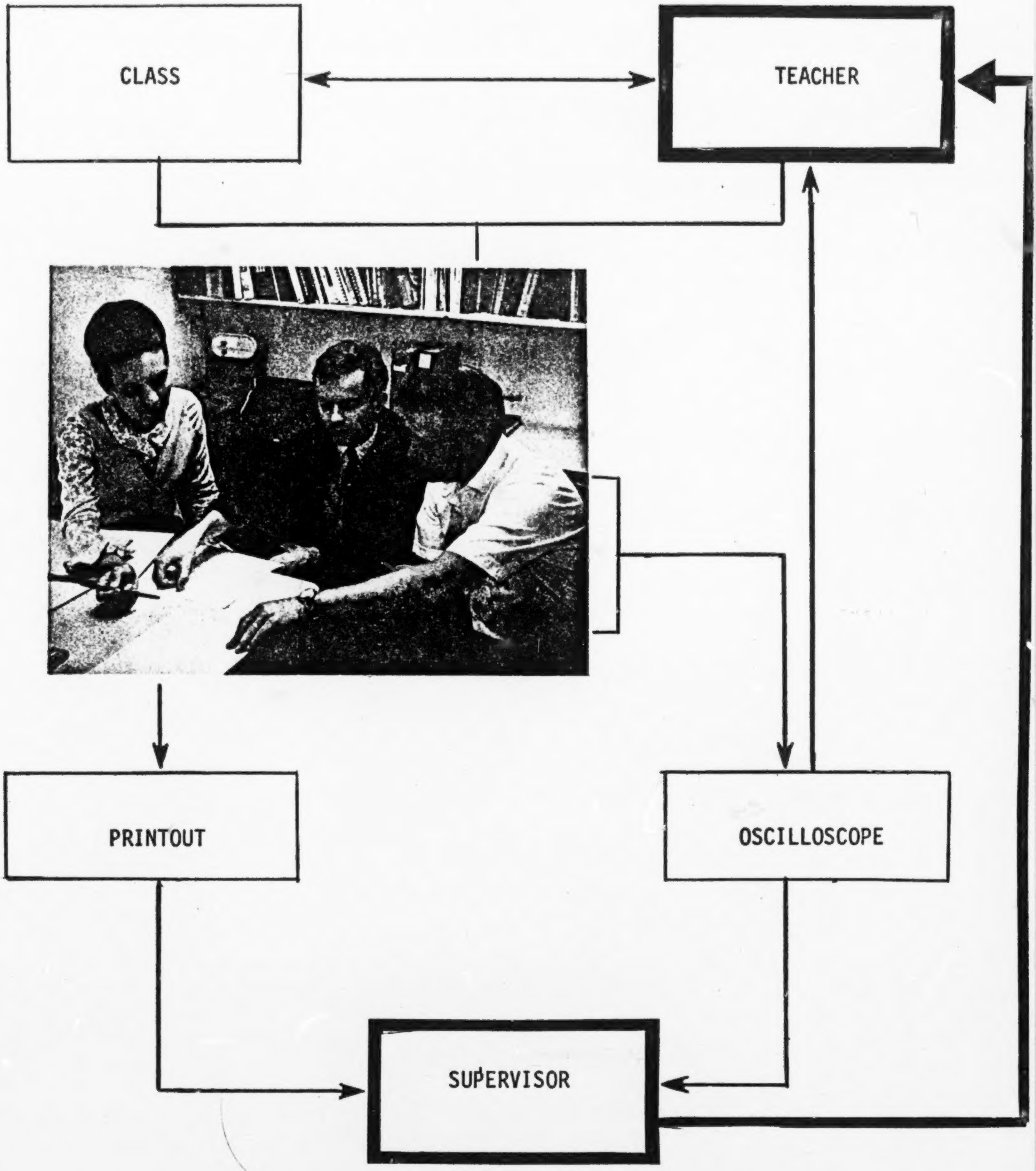

CLASS
TEACHER
PRINTOUT
OSCILLOSCOPE
SUPERVISOR

Figure 9. Experimenter and instructor reviewing baseline performance (Period I) and establishing behavioral goals for Period II.

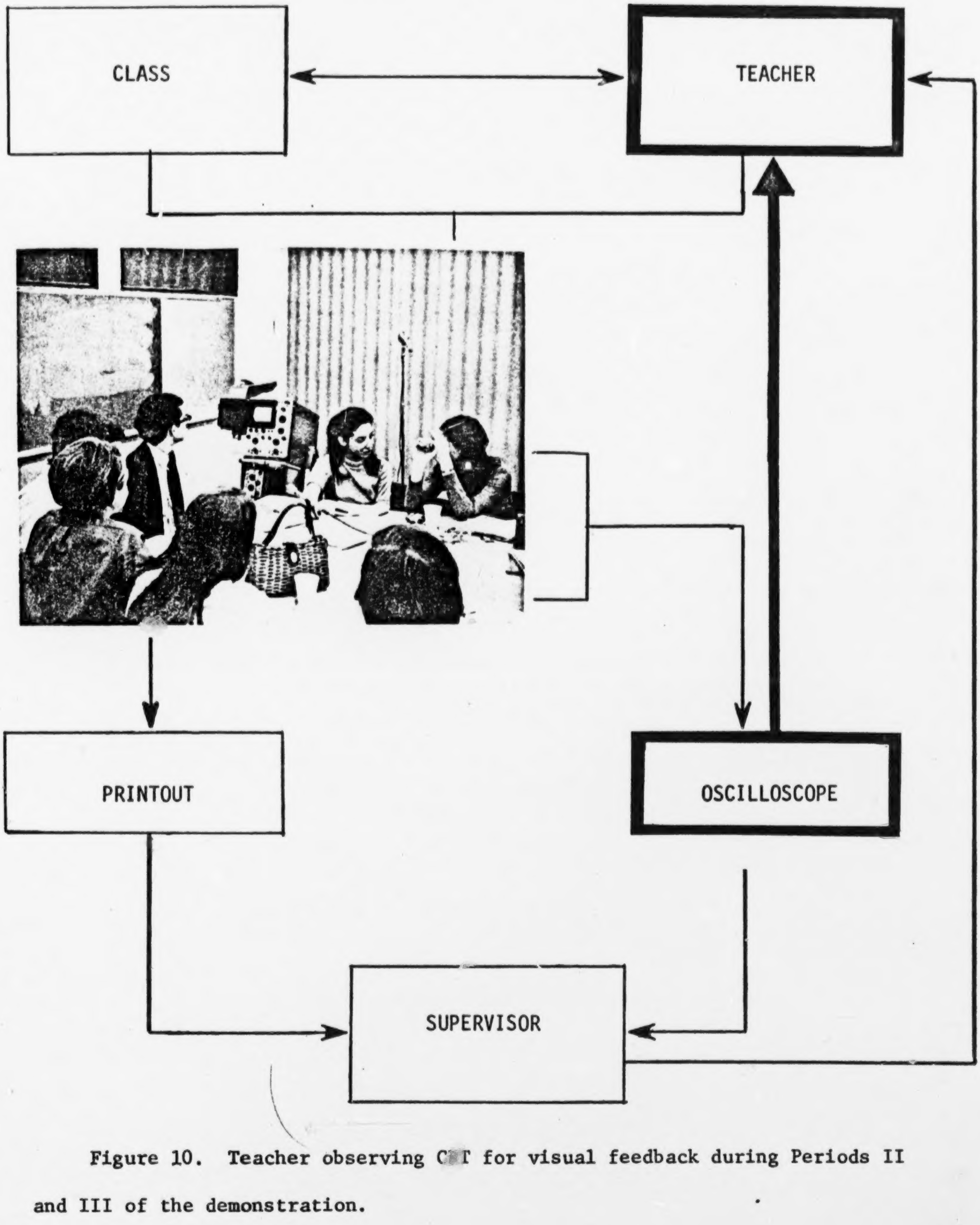

CLASS
TEACHER
PRINTOUT
OSCILLOSCOPE
SUPERVISOR

Figure 10. Teacher observing CRT for visual feedback during Periods II and III of the demonstration.

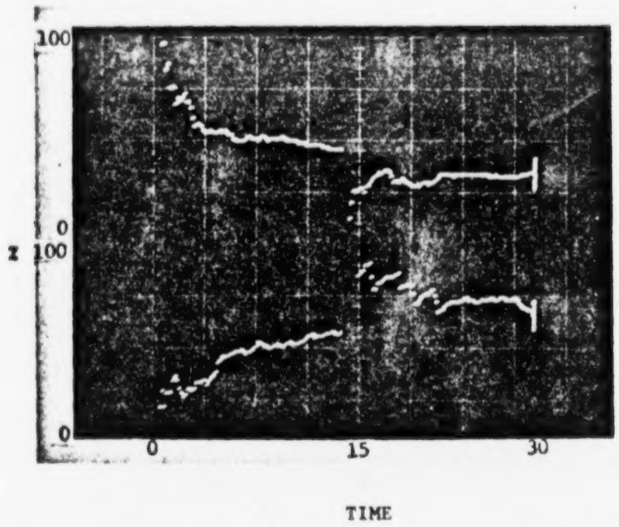
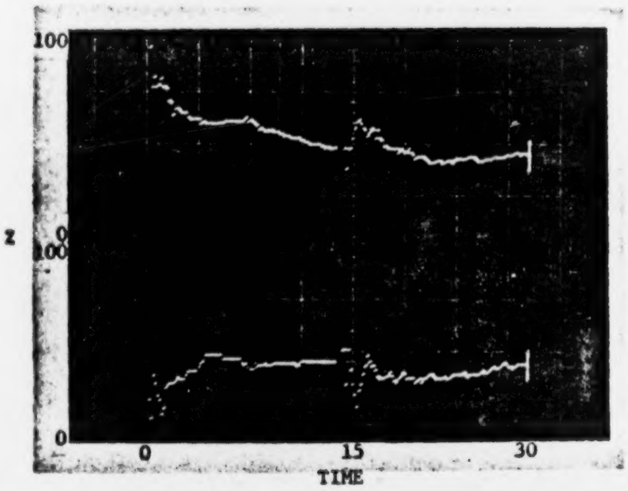


Photo A (Period I)

Shows baseline performance of percentage of teacher moves (upper function) and percentage of teacher moves categorized as reflexive (bottom function).

Photo B (Period II)

Shows the two functions for Period II (second 30 min. teaching period). Note the reduction of reflexive moves from Period I in Photo A to Period II in Photo B.



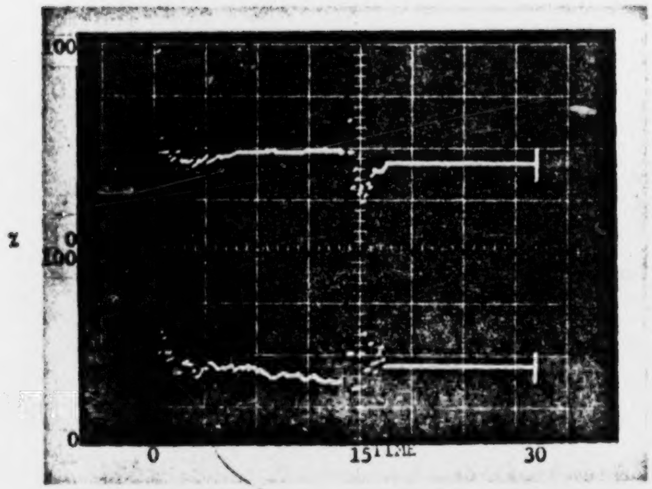


Photo C (Period III)

Shows the cumulative functions for the final period during which time the instructor was asked to maintain the level of reflexive moves achieved during Period II. Note that no data are recorded for the last 12 min. of the final segment because the class was dismissed at the end of 18 min. of Period III.

Figure 11. Polaroid photographs of time-line functions for the three periods covered by the demonstration.

Discussion

The initial use of CATTS in a classroom situation suggested directions for future development and study. It was determined that a teacher could use continuous feedback within a classroom setting with minimal interference to his verbal teaching behavior. With very little introduction to CATTS, the teacher could apparently decode the information presented on the CRT and decode the types of behavior represented by this form of abstraction.

Our observations suggest that the cumulative curve was not sufficiently responsive in reflecting rapid modifications of the interactions in the classroom. The growing number of entries in the cumulative function render the curve less and less responsive to alteration by a single entry. In consequence, the visual feedback used in the demonstration proved sensitive to changes in the classroom only at the beginning of a session. If visual feedback is to be utilized in the CATTS system, then other types of displays and their effects on teacher behavior must be developed and assessed.

It was noted that the number of observing responses by the instructor was relatively low. However, he did claim to have used the scope for information about his success in modifying his behavior. Since an observer cannot be sure whether a teacher is observing the scope or merely gazing in its direction, a teacher call-up system may be necessary. The teacher might be required to press a button to illuminate the CRT display. The computer could record the time and number of the button presses and so provide an accurate record of the teacher's requests for feedback. In this way the relation between the teacher's requests and actual changes in behavior might be determined.

The instructor participating in the pilot study expressed considerable interest in the abstract representation of his classroom behavior that CATTS provided. An interview with him revealed that he felt comfortable in the situation and had many questions about other aspects of his teaching behavior which he was interested in tracking and modifying.

A system such as CATTS, which allows a teacher to focus on his classroom behavior, may well have promise in modifying these complex pedagogical moves. It must be emphasized however, that in this initial demonstration no attempt was made to determine systematically or objectively the effects of CATTS on teacher behavior. The initial work reported here was directed toward determining the feasibility of utilizing CATTS in teacher training--to uncover unexpected problems and to derive suggestions for further developmental work. Pending such further work (e.g., development of hard-and softwear) rigorous experimentation directed toward establishing the general efficacy of the system must be deferred. Improvements in the system are evolving from experience with it, and will be reported in subsequent publications.

Project CATTS IV

SCOPE DISPLAYS DEVELOPED FOR CATTS

Melvyn I. Semmel, Tim Rand, and Jerry Olson

There are currently four displays being tested for use with CATTS. Each presents information on two variables of classroom interaction. The scope is divided into two graphs. The upper graph is reserved primarily for quantitative information, i.e., the amount of teacher talk within total classroom occurrences. The lower graph is reserved for a more qualitative display, i.e., the amount of teacher praise and use of student ideas within total teacher talk.

The ordinates of the graphs represent percentage points from 0 to 100, the abscissae represent time. Since the length of the program is optional up to a limit of 50 min., the displays may represent lessons of varying length. In an effort to compare displays, a single interaction session has been used to illustrate the various display programs.

Display 1: The cumulative percentage function (CPF). In this display a curve is formed on the scope by entering a mean percentage point of all tallies up to that point every 10 sec.

An advantage of this display is that it gives a record of the teacher's total performance at any point in time for a particular interaction session.

A major drawback is that with a growing number of entries, the function becomes less responsive to any one particular entry. As a result, it is increasingly difficult for the teacher to effect a change in the plotted function toward the end of a session. For example, in the session used for illustration, the cumulative mean percentage of teacher talk (top function) increased only eight percentage points during the last 7 min. of the class, although the teacher was observed to have talked constantly during this time period.

Insert Display 1 About Here

Display 2: The moving window percentage function (MWPF). This display was designed to make the CPF more responsive to short-term immediate changes during a session. For this curve, an entry is made on the scope approximately every 10 sec. However, the entry represents the mean of the previous 60 tallies for that particular graph. (Time and number of tallies are choice points in the program: The experimenter may specify N tallies or X amount of time.)

For all of the displays presented here the coding system employed was Interaction Analysis, which requires a tally every 3 sec. Therefore, the choice of 60 tallies for Display 2 entailed a 3-min. time period. If another coding system were used, the relation between time and number of tallies would change.

Since the same lesson was entered for all of the display illustrations, a comparison of the displays on the same information is possible. The more dramatic responsiveness of the MWPF to a decrease in teacher talk (toward the middle of the lesson in the illustration) might have a different effect on the teacher receiving feedback than the more conservative changes of the CPF. The drop in teacher talk seemed to be associated with a rise in the teacher use of praise and student ideas in the illustration session, a result that is not so readily observable in the CPF display of the same data.

Insert Display 2 About Here

Displays 3 and 4: Approximation to a goal. In these displays every 20 tallies are summed by the computer and a mean of those tallies is entered on the scope. Also on the scope is a line representing a goal for the level of the variable being recorded.

Display 3: Stationary goal (AG-S). For illustration of this display, the top graph has a "goal" line plotted at the 60% level. This level is optional in the program; it was selected here only for demonstration purposes.

The AG-S display differs from the others in its responsiveness to time. It continues to make entries every 10 sec. at the level of the previous entry until an additional 20 tallies are accumulated. Therefore, the length of the line on the scope represents the amount of time it took to accumulate the succeeding 20 tallies. When the 20 tallies accumulate, the mean of those tallies is computed and entered at a new level on the scope. A numerical representation of the level of the preceding 20 tallies is also presented.

Insert Displays 3 & 4 About Here

Display 4: Graduating Goal (AG-G). The bottom graph also displays a "goal" line. However, this line represents an increasing percentage level although it is a horizontal function on the CRT. In other words, the ordinate of the graph varies in its percentage values depending on the point in time of the entry on the scope.

For all of the displays presented here the coding system employed was Interaction Analysis, which requires a tally every 3 sec. Therefore, the choice of 60 tallies for Display 2 entailed a 3-min. time period. If another coding system were used, the relation between time and number of tallies would change.

Since the same lesson was entered for all of the display illustrations, a comparison of the displays on the same information is possible. The more dramatic responsiveness of the MWPF to a decrease in teacher talk (toward the middle of the lesson in the illustration) might have a different effect on the teacher receiving feedback than the more conservative changes of the CPF. The drop in teacher talk seemed to be associated with a rise in the teacher use of praise and student ideas in the illustration session, a result that is not so readily observable in the CPF display of the same data.

Insert Display 2 About Here

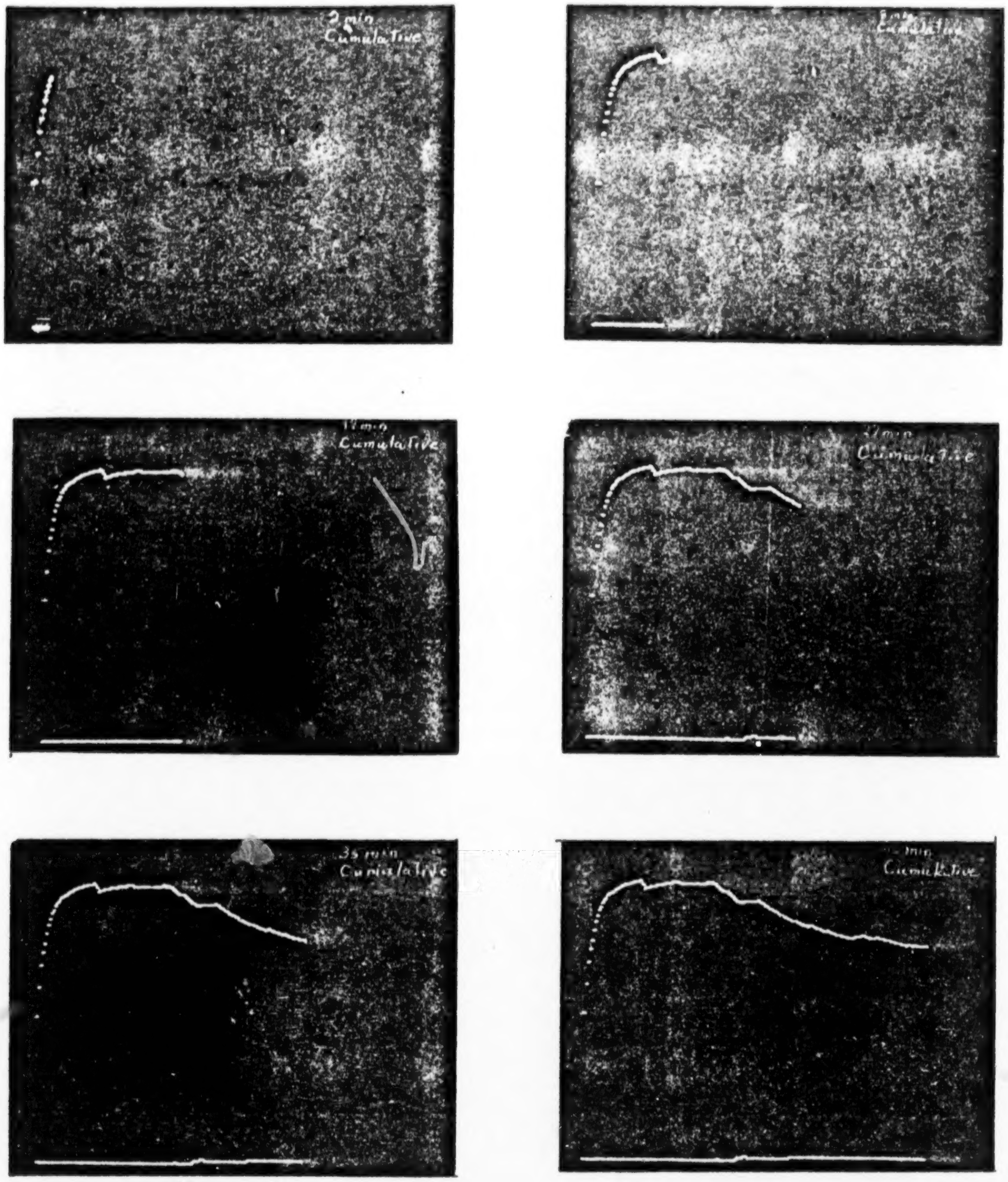
Displays 3 and 4: Approximation to a goal. In these displays every 20 tallies are summed by the computer and a mean of those tallies is entered on the scope. Also on the scope is a line representing a goal for the level of the variable being recorded.

Display 3: Stationary goal (AG-S). For illustration of this display, the top graph has a "goal" line plotted at the 60% level. This level is optional in the program; it was selected here only for demonstration purposes.

The AG-S display differs from the others in its responsiveness to time. It continues to make entries every 10 sec. at the level of the previous entry until an additional 20 tallies are accumulated. Therefore, the length of the line on the scope represents the amount of time it took to accumulate the succeeding 20 tallies. When the 20 tallies accumulate, the mean of those tallies is computed and entered at a new level on the scope. A numerical representation of the level of the preceding 20 tallies is also presented.

Insert Displays 3 & 4 About Here

Display 4: Graduating Goal (AG-G). The bottom graph also displays a "goal" line. However, this line represents an increasing percentage level although it is a horizontal function on the CRT. In other words, the ordinate of the graph varies in its percentage values depending on the point in time of the entry on the scope.



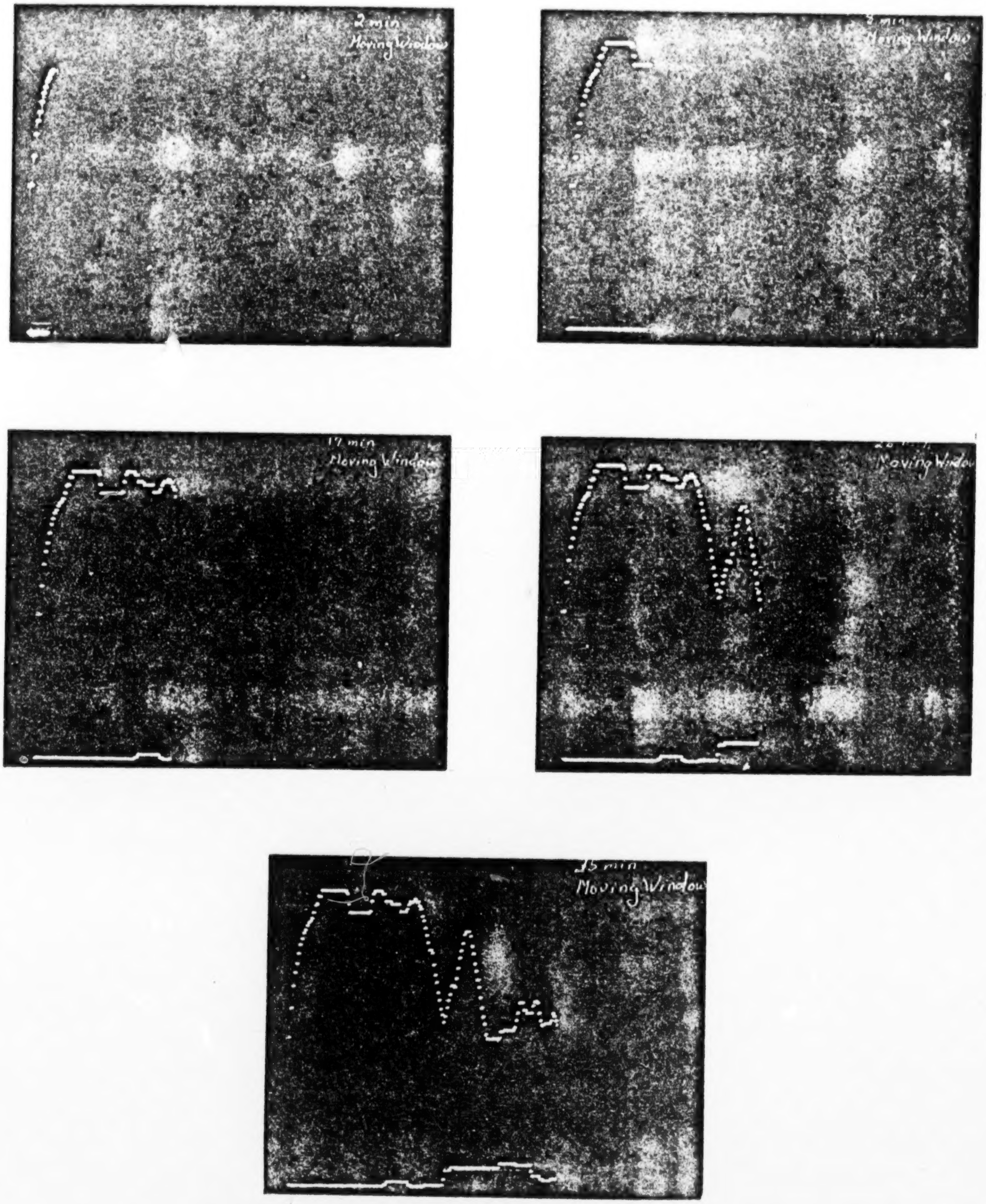
Display 1: The cumulative percentage function (CPF)

Displays 1 - 4. Program length (optional to 50 min.): 45 min.

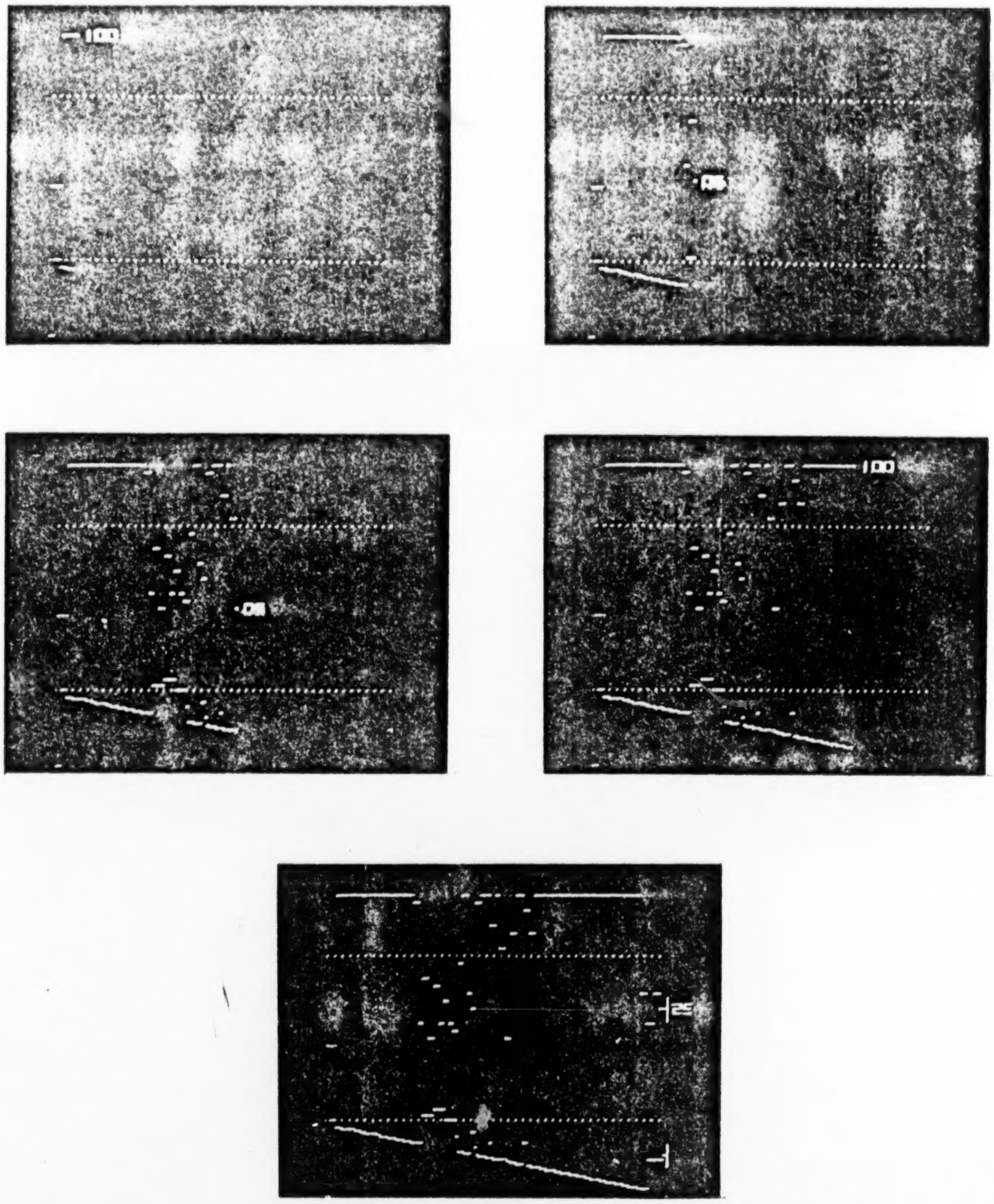
Top Graph: Percentage of teacher talk to total classroom occurrences.

Bottom Graph: Percentage of teacher use of praise and student ideas to total teacher talk.

Oscilloscope enters mean percentage every 10 sec.



Display 2: The moving window percentage function (MWPF)



Display 3: Stationary Goal (AG-S). Top Graph: Goal line equals 60% (optional). 20 tallies are accumulated and their mean entered every 10 sec. until 20 new tallies accumulate.

Display 4: Graduating Goal (AG-G). Bottom Graph: Goal line begins at 10% and increases over time to 100% (optional). 20 tallies are accumulated and their mean entered in relation to the graduating goal every 10 sec. until 20 new tallies accumulate.

In the illustration the "goal" line increases from 10% at the beginning of the lesson to 100% at its end. The values set for this line are optional. The teacher's performance on the use of praise and student ideas remained fairly constant, with some increase toward the middle of the lesson. The gradual rise of the preset criterion is reflected in the decreasing function of the teacher's performance in relation to the goal line.

Displays 3 and 4 appear to be most useful for shaping behavior toward a predetermined goal. Some degree of sophistication on the part of the trainee may be necessary for their effective use. A perceptual disadvantage arises when numerous changes in the level of behavior result in a "scattergram" on the scope. The ensuing difficulty for interpreting the image at a glance may limit the usefulness of Displays 3 and 4.

A version of the moving window might be practical in combination with Display 4. Instead of an entry every 10 sec. to represent the last 20 tallies accumulated, an entry could be made every 10 sec. to represent the last 20 tallies available. The result would provide a picture of fluctuations around the goal line and eliminate the dramatic changes in percentage level which are characteristic of Display 4 in its present form.

Project CATTS V

REVIEW OF LITERATURE RELATED TO THE DEVELOPMENT OF CATTS

M. I. Semmel, J. Schmitt, and H. Van Every

This preliminary review is divided into three sections corresponding to the major facets of Project CATTS: (a) the problem of training special educators (with emphasis on mental retardation), (b) the analysis of existing analytical systems of classroom teacher-pupil interaction, and (c) the role of feedback variables in teacher training.

A. The Problem of Training Special Educators

Critics of teacher education contend that too much emphasis is being placed on dispensing information and unrelated theory (Bruner, 1963; Heathers, 1964). While research in the preparation of teachers has increased (Gage, 1963), more attention must be directed toward the teacher's activities in the classroom (Anderson & Junka, 1963; Warburton, 1962). Teacher education should be organized around operational definitions of training objectives and the teacher-learning process (Heathers, 1964).

The level of scientific rigor of research in any field is often related to the level of previous research in that field. Research on teacher preparation in special education prior to the mid-1950's was indeed wanting (Cruickshank, 1965). Between 1959 and 1965 the work reported seemed to be primarily at the stage of early development. Special education lagged behind the general field of education in the output of empirical research, or teacher education (Cain, 1964). Blatt's (1966) survey of the literature yielded no experimental studies and few investigations of any kind that could be classified as systematic research. The few descriptive studies completed were of the opinionnaire-questionnaire sort.

The Preparation of Teachers of the Retarded

Some problems encountered by teachers of the retarded were demonstrated in a study of the teaching of reading by Mullen and Itkin (1961). They indicated that teachers of the retarded need a more adequate preparation than they are getting. Moreover, teachers themselves have felt their lack of training (Cain & Levine, 1961; Mackie, Dunn, & Cain, 1960). Sparks and Blackman (1965) suggested as a topic of investigation the hypothesis that special preparation results in a special approach to teaching the retarded child. Teachers of the retarded tended to restrict their interests in teaching methods to those applicable for the retarded (Mackie, Dunn, & Cain, 1960). Teachers need inter-disciplinary training with emphasis on broad concepts rather than on specializations (Cain, 1964). Heber (1963), citing recommendations of a national conference on standards for the preparation of teachers of the retarded, emphasized the need for more training in the biological and behavioral sciences. Both Cain and Heber suggested that teacher candidates need direct contact with children while training.

According to Fliegler (1966), the preparation of personnel in mental retardation is in a heightened state of flux: innumerable pressures from diverse areas of our society are demanding more qualified teachers; yet not only are we faced with a shortage of teacher-candidates of suitable quality but we also have limited knowledge of how best to educate a teacher.

Blatt (1964), who discussed the inadequacy of present teacher-preparation systems, maintained that teacher-preparation programs had to include sustained intellectual discipline, with substantial work in the behavioral and social sciences, all this associated with a process of continuous self-evaluation. Blatt took issue with the notion that highly complex classroom interactions could be usefully measured, and suggested an alternative strategy--measuring the simplest interaction. Ideally, the more control exercised over the environment, the more accurate the measurement would be. The measurement of teachers' interactions with children should be more concerned with their "doing" behavior than with their "internal" behavior. Since it is difficult to measure what a teacher is feeling or thinking, we must concern ourselves with his performance. In the last analysis, the overt behavior of teachers with children constitutes the only meaningful interactions we have to record.

For Gallagher (1967) the key to teacher preparation is in the demonstration to the teacher of how to interact meaningfully with the learner. This preparation must be mastered through observation, practice, and the provision of sufficient feedback about his performance to allow the teacher to analyze his behavior and to modify it systematically.

Olson and Hahn (1964) described and analyzed a special approach to preparing teachers of the mentally retarded. They recommended that undergraduate candidates have the following experiences: (a) a sound general education, with emphasis on the behavioral sciences, (b) early exposure to the field of special education, (c) instruction in curriculum and teaching methods, and (d) the opportunity to observe excellence in teaching. They assigned particular emphasis to observation and practice teaching. Directed observation of excellent teachers in action should be followed by a seminar in which the professor and the student jointly evaluate what was observed. These demonstrations might take place in public school classrooms, in university demonstration classes, and under certain conditions, in university classrooms where the curriculum methods course was taught. During the last phase of teacher preparation students should be assigned to full-time student teaching with provision for weekly seminars concentrating on problems encountered during the teaching day.

According to Fuchigami (1967), a critical problem in teacher education programs is the employment of adequately trained critic teachers. His solution: a university course to train critic teachers for supervisory roles in the area of mental retardation.

Shane and Shane (1967) proposed an extensive in-service training program involving the use of a model demonstration-observation classroom and the establishment of an extension course through a university or college.

Fouracre (1966) addressed himself to deficiencies and suggested improvements in the practicum for student teachers of the MR. He found these deficiencies in present teaching programs: (a) the students are assigned to a classroom where the program is planned by the cooperating teacher, (b) the students have limited classroom responsibility, (c) the students are permitted to read case records before entering the classroom, (d) the coordinator has little control over the student teacher, and (e) the college supervisor's visits are brief and conducted without knowledge of the student's lesson plan. According to Fouracre, a desirable practicum should include: (a) close cooperation between the college and the participating school, (b) a competent cooperating teacher, (c) adequate college supervision of the practicum, (d) a college supervisor selected on the basis of a successful background of classroom management, use of teaching methods and materials, and curriculum development. The supervisor should be appointed and paid jointly by the college and the participating school.

Teachers of the trainable mentally retarded (TMR). A number of sources have listed the components of a TMR teacher-preparation program (Cain & Levine, 1963; Connor & Goldberg, 1960; Council for Exceptional Children, 1966; Heber, 1963; Wolinsky, 1959). Wolinsky (1959) analyzed aspects of a teacher education program for those preparing to work with the trainable child. She recommended three areas of study to be incorporated into any such program: (a) an adequate foundation in developmental psychology, including emphasis on laboratory experiences and the case-study approach, (b) acquaintance with basic skills and insights of other disciplines concerned with atypical children, (c) awareness of basic principles of counseling and interviewing. Of particular interest is the preliminary report to the Professional Standards Committee of the Council for Exceptional Children, in which preparation of teachers of the TMR was considered separately from that of teachers of the educable mentally retarded (EMR). Areas requiring intensive attention for teachers of the TMR were these: (a) cognitive growth, perception, and sensorimotor development, (b) research and evaluative skills, (c) language development, (d) concepts of leisure time, (e) occupational education, (f) counseling of parents, and (g) the role of the teacher as an eliciting stimulus.

Lance (1968) reported a pilot program under development at California State College at Fullerton to prepare teachers of the TMR. The program includes a one-semester seminar and practicum course to precede student teaching. During this seminar and practicum, the student spends three hours a week in seminar and nine hours in practicum, all under the supervision of a college faculty member. The seminar and practicum replaces a separate course in curriculum and methods and attempts to cover the same material in a more integrated and meaningful fashion.

Teacher competency. Conant (1963), Keppel (1961) and Sarason, Davidson and Blatt (1962) agree that to improve teaching competency, professional education should intervene once the student has gained a firm footing in general education and in content areas. However, they disagree on when professional education should be initiated and how general competency is best attained. For some (Keppel, 1961; Sarason et al., 1962), professional education should come in the last year of a five-year program; according to Conant (1963), however, teachers can be prepared in four years. The five-year work-study plan proposed by Trump (1958) and use of undergraduate seminars (Sarason et al., 1962) reflects the current emphasis on practical experience for potential teachers.

Many organizational plans have been developed that have implications for the preparation of teachers (Hillson, 1965). Team teaching appears to be receiving considerable attention in institutions of higher education (Shaplin

& Olds, 1964) as is the clinical approach (Schwartz, 1967a, 1967b; Smith, 1968). Schwartz (1967a) described an integrated teacher education program designed to prepare teachers for the education of exceptional children. He favors integrating the five traditionally separate training areas in special education into one curriculum, on the principle that every teacher must be a diagnostician who teaches each child at his own level, makes use of the child's capabilities, and ignores the formal etiological classifications.

Characteristics of special education teachers. Although many studies have reported the characteristics of regular class teachers, there is a lack of empirical information about the characteristics of effective special education teachers and about the predictors of effective teaching of the mentally or physically handicapped. The frequently quoted study reported by Mackie, Williams, and Dunn (1967) is no exception to this generalization.

To identify and quantify the traits which contribute to successful student teaching of mentally and physically handicapped children, Meisgeier (1965) investigated five dimensions of human behavior. Three characteristic patterns emerged: The successful student teachers (a) were well-adjusted, emotionally stable, and able to cope with difficult special class situations, (b) they possessed physical energy, vitality, and enthusiasm necessary to meet special classroom demands, and (c) they obtained high scores on measures of scholastic achievement and ability.

Willman (1966) investigated the significant differences between special education and elementary teachers on the Edwards Personal Preference Schedule, The Minnesota Teacher Attitude Inventory, the Study of Values, and a biographical data sheet. Differences in basic needs, attitudes, and interests were anticipated in the light of Murray's (1938) contention that differences in desired goals are the result of differences in basic needs. The results revealed relatively large differences in the basic needs, attitudes, and interests of prospective special education and of elementary teachers. However, relatively small differences were found among education majors in the various areas (e.g., mental retardation, emotional disturbance) of special education.

Several studies (Cawley, 1964; Garrison & Scott, 1961; Jones & Gottfried, 1964; 1966; Philippus, 1961; Roberts, 1962) have described the personality characteristics of teachers or prospective teachers of exceptional children. Gottfried and Jones (1964) explored some of the underlying factors in the choice of a career in special education. Using a questionnaire technique, they collected information about (a) previous contact with handicapped persons, (b) data of career choice, and (c) reasons for entering the field. Analysis of the data showed that approximately 40% of the respondents had had some prior experience with handicapped individuals. Most of the respondents reported deciding on a special education career in the senior year of high school or freshman year of college. The most frequently stated reasons for entering the field were previous contact with handicapped children, a desire to help others, and the challenge of the work.

In a later study, Jones and Gottfried (1966) investigated the personality and motivational characteristics not only of teachers employed or expressing interest in teaching various types of exceptional children but also of prospective elementary and special education teachers. Besides completing one of two standardized tests (The Edwards Personal Preference Schedule or the Teachers Preference Schedule), each subject ranked his preference for teaching 12 different types of exceptional children. The results suggested that preferences for teaching various types of exceptional children are related to specific psychological needs and gratifications.

Philippus (1961) investigated the values and interest patterns of student teachers in elementary, secondary, and special education at the University of Denver. Significant differences were found between the special education and elementary education students. The special education group scored highest on the biological science, persuasive, linguistic, and humanitarian scales of the Thurstone Interest Inventory, on the debonair sexual and general uninhibitedness scale of the IPAT Humor Test, and on the religious scale of the Study of Values.

Roberts (1962) compared the needs, interests, and values of elementary, secondary, and special education teachers on the Edwards Personal Preference Schedule, Thurstone Interest Inventory, and the Study of Values. Special education teachers scored relatively high on nurturance needs and computational interests, and relatively low on linguistic interests and political values.

Although Philippus (1961) and Roberts (1962) used some different instruments, their findings point to differences between the prospective and experienced special education teachers; certain personality characteristics may be acquired after an individual begins teaching.

An important limitation of most teacher characteristics studies, not found in those reported by Philippus (1961), Roberts (1962), and Willman (1966), is that investigators generally failed to test teachers of non-exceptional children or persons employed in other occupations. Thus, while a given constellation of traits may be seen as characteristic of teachers of a given type of exceptional child, the traits may in reality differ little from those of persons in a wide variety of seemingly diverse occupations.

According to Lord and Wallace (1949), the influence of friends and relatives, as well as actual contact with exceptional children, helped shape the decision to become a special education teacher. These findings were confirmed by Gottfried and Jones (1964) and by Meyers (1964). In all three studies there was some evidence that preteaching experience is related to the decision to teach exceptional children.

Several studies (Badt, 1957; Jones & Gottfried, 1962; Meyers, 1964) of preferences for teaching exceptional children reveal that certain teaching specialties have greater attractiveness than do others--in particular, work with the emotionally disturbed, the gifted, and the retarded.

In her study of the status of teachers of the mentally retarded, Rich (1960) focused on the personal background of teachers. She found that 62% of her sample preferred to teach the mentally retarded because the work seemed more challenging, but 12.2% of the teachers would have preferred to teach in the elementary grades. Reasons given by teachers for discontinuing their work with the mentally retarded included: (a) a desire to return to regular classroom, (b) difficulty of the work, (c) discouragement with the results obtained, and (d) lack of emotional stability.

Heller (1964) studied the relationship between certain background characteristics of special education teachers and their decision to leave special education. He found a significant relationship between the decision to leave the field and a lack of previous experience with exceptional children. Teachers leaving the field ranked the factors influencing their decision in the following order: (a) lack of adequate supervision and administrative support, (b) undesirable working conditions, (c) lack of adequate college preparation for teaching, (d) lack of acceptance by fellow colleagues in education, (e) inability to manage classroom, (f) lack of acceptance of special education by the community, (g) family and personal reasons, (h) economic reasons, and (i) lack of stimulation.

Attitudes of college students toward handicapped groups have also been studied (Badt, 1957; Barker, 1953; Means, 1936; Mussen & Barker, 1944; Rusalem, 1950; Rusk & Taylor, 1946). However, research on the attitudes of special education majors and experienced teachers as compared to those of elementary education majors and experienced teachers is relatively exiguous. Semmel (1959) investigated teacher attitudes toward mental deficiency in relation to the amount of information about the condition. As expected, the special education teachers showed significantly greater knowledge of mental deficiency than did elementary teachers. There were, however, no significant differences in attitudes between the two groups.

Some data are presently available to aid the selection of candidates as teachers of exceptional children. The Minnesota Teacher Attitude Inventory has been used in a screening process (Condell & Tonn, 1965; Meisgeier, 1965). Johnson (1964) developed a questionnaire that may help determine some of the important variables of past experience with the handicapped as related to current interest and possible success. Lance (1968) recommends Hudson's (1960) checklist of teaching competencies of teachers of TMR children as a screening or evaluation device.

The foregoing review suggests that critics of special-education teacher education programs are correct in their assertion that little relevant research has been conducted in this field. Systematic research on training teachers of the mentally retarded is almost non-existent. In the following section of this paper, research using analytical systems of classroom interaction is reviewed. These systems and the research they motivate have direct relevance to the general question of teacher training in special education.

B. Analytical Systems of Classroom Interaction

This section of the review is organized in accordance with the focus of various proposed systems for analyzing classroom behavior. The two focal areas in question are: (a) cognitive processes, and (b) social-emotional climate.

Cognitive processes. Smith and Meux (1962), in one of the first studies in this area, sought to determine what logical patterns, if any, were to be found in teaching. They analyzed tapescripts from 85 class sessions of 17 high school teachers of four different subject matters in terms of two basic units (episode and monologue). An episode was defined as one or more exchanges which in the aggregate comprise a completed verbal transaction between two or more speakers. The monologue consisted of the sole performance of a speaker addressing the group. Episodes were found to contain opening, continuing, and closing phases. They constructed 13 categories to analyze the opening phase of episodes. Differences in logical operations are found from teacher to teacher and from subject matter to subject matter.

A multi-dimensional approach was developed by Medley and Mitzel (1963). The authors criticized their own observational scale (OScAR) because it failed to examine the cognitive aspect of classroom interaction, which they believed to be more important than the social-emotional aspect.

Using Piaget's theoretical model, Taba, Levine, and Elzey (1964) constructed a classification system employing pedagogical function and level of thought as its categories. The authors trained 20 elementary school teachers to use a social skills curriculum and teaching strategies designed to develop cognitive skills. They tape-recorded each class four times during the school year. Their findings indicated that such pupil characteristics as IQ, social status, achievement in social studies, and reading comprehension were not correlated with the level of thought expressed in the classroom discussion. Results confirmed the hypothesis that with "good" teaching and a "good curriculum" slow learners were capable of abstract thinking. The manner in which the teacher asked questions turned out to be the most influential teaching act; it circumscribed the mental operations of the students.

Bellack, Hyman, Smith, and Kliebard (1965) studied the teaching process through analysis of the linguistic behavior of teachers and students in the classroom. Wittgenstein's model of language games was used in analyzing the cyclical patterns of pedagogical moves. The classification system devised consisted of three dimensions: pedagogical moves (structuring, soliciting, reacting, and responding), content moves, and emotional moves. Lieman (1966) is using Bellack's system to study the one-to-one relationship of teachers and pupils involved in homebound instruction.

The dimension of intellectual operations derived from Guilford's analysis of the "structure of intellect" became the basis for GACS, the Gallagher-Aschner Classification System (Gallagher, 1965). The five major categories of this system differed from those of Guilford's model in that cognition and memory were combined into one category and a category for routine classroom procedure was added. Each statement in the classroom was assigned to one of the following categories: (a) Routine, (b) Cognitive-Memory, (c) Convergent Thinking, (d) Evaluative Thinking, and (e) Divergent Thinking.

In addition to tape recording the proceedings, two observers in the classroom during each recorded session took extensive notes on the classroom activities. They noted, for example, such features as blackboard diagrams and written materials. In addition, they tried to identify the more obvious attitudinal dimensions of interaction between teacher and class, such as censure, praise, frustration, and humor. Each transcribed classroom session was then classified, unit by unit, by trained judges working with the scoring manual developed for this purpose. These codings were transferred to a flow chart for more extensive analysis.

Gallagher (1965) used the GACS to study the verbal interaction of five superior social studies, science, and English teachers and their intellectually gifted high school students. He concluded that the teacher had the crucial role of initiator and determiner of the thought processes expressed in the classroom. He is in a position to facilitate or inhibit the development of effective productive thinking in his students. If the teacher's behavior is so important for the intellectual development of gifted children who are capable of much independent learning, then it must be still more important for the development of mentally retarded children who purportedly are less capable of independent learning.

Aschner (1963) used the GACS to investigate the relationship between the variables of IQ and class size on the one hand and, on the other, student initiative, which was operationally defined in terms of specific secondary categories. Gifted high school students exhibited significantly more initiative than average and mentally retarded students; however, the mentally retarded subjects produced more initiative units than the average students. Aschner attributed this finding to the informal, comfortable atmosphere created by the special-class teacher.

Using the GACS, Cawley and Chase (1966) compared the verbal interactions of retarded children in special classes, retarded children in regular classes and non-retarded children in regular classes. The results for all three types of classes were similar. Of the total units produced, one-half were classified as cognitive-memory, 80% as cognitive-memory and routine combined, and less than 5% as evaluative and divergent thinking.

Minskoff (1967) used the GACS to examine the verbal interaction in MR classrooms characterized by Goldstein's inductive method of teaching. She found that teachers used more cognitive-memory questions than other question types. Approximately equal amounts of convergent-thinking, divergent-thinking and evaluative questions were used by the teachers. Minskoff's prediction of a high positive correlation between the thought process implied by a question and the type of response produced by a student was supported. However, the predicted differences between the inductive teachers and a control group, when measured on verbal interaction, were not confirmed.

David and Tinsley (1967) developed the Teacher Pupil Question Inventory (TPQI) which uses the questions asked by student teachers and their pupils to determine the range of cognitive objectives manifest in secondary social studies classrooms. The TPQI schedule requires a classroom observation of 30 min., divided into alternating 5-min. periods. At each instance of a question asked by either the teacher or pupil, the observer decides the category of the question and marks a tally in a space provided. Questions are judged by their form and inferred intent as well as by the nature of the response elicited and its reception by the pupil or teacher. The TPQI has nine categories, seven of them based on the Bloom taxonomy and the formulations of Sanders (1966). The other two categories concern non-cognitive questions. The results revealed that both teachers and pupils asked more "memory" questions than all other questions combined. The next largest number of questions fell into the "interpretation" and "translation" categories. "Procedure" questions for both teachers and pupils and "evaluation" questions for teachers came next in the descending order of frequency.

Hudson (1960) investigated public day-school classes for trainable mentally retarded children in Tennessee in an attempt to provide more specific information about the "how" of teaching, as illustrated by the teaching techniques used, and the "what" of teaching, as seen in the types of lessons taught. She identified:

(1) Forty-three teaching techniques and
(2) Seven "a-priori" clusters:
  (a) controlling individuals and groups,
  (b) getting the children willing to start and continue working,
  (c) building a sense of personal worth in the children,
  (d) structuring or guiding learning,
  (e) encouraging cooperative interaction,
  (f) providing for mind-set or attention,
  (g) drawing from children--as opposed to pouring in--Verbal.

Hurley (1967), while developing a system for analyzing teacher-pupil verbal interaction, reported several findings:

(1) In terms of the number of words uttered, teachers did about 85% of the talking.
(2) EMR children averaged less than one complete sentence per utterance while the teacher produced more than two.

(3) About 80% of the teacher's sentences were structurally complete, whereas only about 20% of the children's sentences were.

(4) The children were seldom given the opportunity to use structurally complete sentences (nor were they asked to). During recorded sessions totalling 4 hrs. 24 mins. only 41 complete sentences were uttered by the children.

(5) According to the normative tables provided by Johnson, Darley, and Spriesterbach (1963), the level of the children's language was roughly that of a five- or six-year-old.

(6) The children's complete sentences were compared to an equal number of randomly selected teacher sentences by means of an initial version of the modified Shriner Length and Complexity Index (LCI) (Shriner, in press); teachers' sentences showed a wider range of complexity than the children's.

Social-emotional climate. The dimension of classroom interaction most frequently studied has been the social-emotional climate (Medley & Mitzel, 1963). The forerunners of such studies were those by social psychologists such as Bales (1951) who observed small group social interactions. Anderson's (1939) studies on dominative and integrative teaching patterns pioneered social-emotional research in the classroom. Withall (1956) derived a climate index to reflect the degree to which a teacher was learner-supportive (integrative) or teacher-supportive (dominative).

Flanders (1961; 1963; 1964; 1965) has reported the most comprehensive program of investigation based on classroom observation. His Interaction Analysis (IA) technique is composed of ten categories: Teacher (a) accepts feeling, (b) praises or encourages, (c) accepts or uses ideas of students, (d) asks questions, (e) lectures, (f) gives directions, (g) criticizes or justifies authority; Pupil (h) responds, (i) initiates, and classroom behavior consists of (j) silence or confusion. In using IA, an observer decides, during 3-sec. intervals, which category most appropriately describes the interaction taking place in the classroom. The observer records the category numbers in the sequence in which they occur, and so preserves the original order of verbal events. For example, the sequence of tallies "4-8" means that the teacher asked a question and a student responded.

The observer also notes the types of activity (e.g., discussion, filling out materials, etc.), the class formation, and the subject matter. Each time there is a shift in activity, formation, or subject matter, the observer notes the changes and continues tallying.

At the end of an observation period the frequency of tallies in each category can be counted, and the percent occurrences of each behavior category determined. For example, during a science discussion a teacher might praise 1% of the time, lecture 30% of the time, and ask questions 12% of the time.

Since the order of verbal behavior is preserved in the tallying, it is also possible to determine how often one category follows another. For example, a teacher might praise student's initiation 5% of the time that it occurs, and praise students' response 20% of the time. Comparing behavior during two sets of observations, when the objectives may be different, can lead to some useful inferences about the nature and causes of changes in teacher and pupil behavior. The data may also be used for feedback to teachers.

Semmel, Herzog, Kreider and Charves (1967) used Flanders' IA technique to compare two groups of seven TMR classrooms. The sample was selected from a population of 87 TMR classrooms on the basis of high and low teacher scores on the Minnesota Teacher Attitude Inventory (MTAI). High MTAI teachers used more questions and had more student response. Low MTAI teachers used more lecture and criticism and had more student-initiated talk.

Semmel, Herzog, and Jorgenson (1965) used the IA system to compare classes for the educable mentally retarded (EMR) and normal elementary school children. Five elementary and five intermediate special classes were chosen, together with regular classes of normal students of the same chronological ages. Differences in both the amount and nature of teacher talk in the two types of classes were found.

Fine, Allen, and Medvene (1967) measured the verbal interaction patterns in regular and special classrooms (EMR) according to the code of the Verbal Interaction Category System (Amidon & Hunter, undated). The null hypothesis, that interaction patterns would not differ between EMR classes and regular classes matched on chronological age, mental age, and social class, obtained support from the correlational data. Worth noting, however, are the relatively less extended teacher talking and the relatively greater pupil-initiated, pupil-to-pupil and pupil-to-teacher interactions found in the EMR classrooms.

Hughes (1962), analyzing three 30-min. tapes from 41 elementary teachers, found that teachers demonstrated different patterns in teaching and that the differences affect the learning of children. In his study he used the

Semmel, Schmitt, & Van Every
University Revision of the Provo Code for the Analysis of Teaching. It contains 33 functions that teachers perform in the classroom in interaction with children. Seven major categories are identified: (a) controlling functions, (b) imposition of teacher, (c) facilitating functions, (d) functions that develop content, (e) functions that serve as response, (f) functions of positive affectivity, (g) functions of negative affectivity.

Perkins (1964) constructed two instruments, Student Categories and Teacher Categories, derived from instruments for measuring student-behavior, learning-activity, teacher-behavior, and teacher-role variables presumed to be related to differences in achievement. He concluded that using these instruments to determine the ways teachers resemble and differ in behavior, function, role, and teaching process promises further breakthroughs in studying teacher influence and effectiveness and in developing a theory of instruction.

MacDonald and Zaret (1968) focused on the interactive verbal behavior of teachers and learners in a specific instructional context (a social studies discussion or planning session) in order to ascertain whether the proposed process continuums stretching from open to defensive and compensatory behaviors could be reliably identified, categorized, and analyzed. The goal of their work was to use the tested framework to generate hypotheses for future broad and intensive studies on ways to increase effectiveness in teaching. MacDonald and Zaret contend that the classification system of the process continuum (opening-closing) is a promising tool for interaction research in classrooms.

Pierce (1967) recorded 96 teachers of culturally divergent children on vidicon (90-min. segment) and classified the reinforcement behaviors used into the following categories: (a) Positive Verbal, (b) Negative Verbal (C) Positive Physical, (d) Negative Physical, (e) Positive Covert, (f) Negative Covert, (g) Supplemental Enrichment. Negative types of reinforcement turned out to be more easily identified than positive types.

Gallaway (1968) set up seven categories for observing a teacher's nonverbal communication with pupils in instructional settings. The purpose was to enable observers to make inferences about the nonverbal behavior of a teacher. When a communicative act pertinent to the category system occurred, observers recorded a number standing for the category. Three of the categories (enthusiastic support, helping, receptivity) were considered as encouraging communication, three as inhibiting it (inattentiveness, unresponsiveness, disapproval). The neutral category, pro forma, was considered as neither encouraging nor inhibiting.

Of particular interest is the contention that nonverbal messages may be as significant to pupils as are direct teacher verbalizations--particularly when pupils attempt to ascertain the teacher's true feelings and attitudes toward them. The notion is all the more relevant in the case of linguistically disadvantaged youngsters, who get lost in the verbal avalanches of teacher talk in classroom settings and have no other recourse than to rely upon the nonverbal messages of teacher behavior. The research conducted by Bernstein (1961) has shown that youngsters from the lower classes depend upon nonverbal cues for the detection of meaning in school situations.

A summary of the literature of systems for analyzing classroom behavior has shown that a variety of systems has been developed. Some systems focus on the teacher while others focus on both the teacher and the pupils. Most of the systems analyze verbal behavior in the classroom as the prime means of communication, considering it to be a representative sample of the total classroom behavior. Others include or focus on the nonverbal behavior, considering it too significant to omit in spite of the many limitations inherent in dealing with it.

In the area of special education the Gallagher-Aschner Classification System has been used with gifted and mentally retarded high school pupils, and EMR elementary students. Flanders' Interaction Analysis has been used with both TMR and EMR groups; and Bellack's system has been used with the homebound. No research on nonverbal communication within special education programs has been located.

The previous sections of this review have implied the need for information feedback to teachers in training. The final section of this review summarizes the work reported on the role of feedback variables in teacher education.

C. Feedback Variables in Teacher Education

The use of some type of feedback to teachers in training is not new, at least in theory--the traditional role of the supervisor has been to provide meaningful feedback in training programs (Anderson & Junka, 1963).

It is clear from the above review of analytical systems that efforts have been made to standardize the recording of student-teacher behavior for use as feedback to the teacher. There have also been several recent attempts to alter the nature and time of that feedback.

DeViney (1963) used a closed circuit television link for observation of elementary teacher trainees. The effectiveness of TV monitoring was assessed primarily by attitude questionnaires given to the students. No significant findings were reported--the researcher suggested that the dependent measure used was inappropriate.

Oliver (1965) used video recordings for observation. Self analysis of the tapes turned out not to be so effective as help in analysis from a supervisor. More change occurred in student-teacher behavior when visual rather than just verbal feedback was available; and more change occurred when feedback came from an analysis of the video tape by the supervisor rather than from the impressions of an on-the-spot supervisor.

Meir (1967) used systematic visual feedback to teachers from the students, who indicated their reactions by holding up cards at various intervals. This type of feedback influenced teacher behavior and resulted in more appropriate decisions to reteach material. The students in the class did better on post-test performance than did a control group.

Allen and Ryan (1965) described micro-teaching as a new method of supervision. They introduced video-tape recording and short segments of teaching (micro-teaching) as tools and techniques for change. Teaching skills were isolated and described. A novice teacher was shown an example and asked to try himself; his attempt was taped, critiqued, and could be taped and critiqued again. Allen does not claim to have an exhaustive list of teaching techniques but says that his method points the way toward a more objective examination of skills.

Meier (1968) reports the use of micro-teaching as a training technique for teachers of disadvantaged preschool and kindergarten youngsters. Borg (1968) described a similar technique for inservice training of teachers. However, his classification system provided for no other type of student verbal behavior than responding.

Minnis (1968) examined video-taping sequences in terms of Flander's interaction analyses and in the context of a comprehensive training program. Student teachers spent the first phase of their teacher-training career learning interaction analysis. They then observed demonstration teachers. Several teaching patterns were isolated for learning and a technique such as Allen's was used in conjunction with Interaction Analysis during the critique period. Minnis views this type of training program as a powerful tool for continuing self-education after the teacher leaves the training situation.

The use of tape recordings as a substitute for the initial observation period of most teacher-training programs was explored by Mijer (1964). Analysis and discussion of edited tapes effectively replaced lectures.

In an attempt to teach methods of observation and classroom analysis to secondary education trainees, Springman (1966) presented audio-video tapes of classroom situations and asked both student-teachers and experienced teachers to rate them on various observational criteria. Novice and experienced teachers differed in rating inner-city as opposed to suburban classrooms. The student-teachers trained in rating with the help of tape came to resemble the experienced teachers in their judgments more rapidly than did a control group.

Time-lapse photography was introduced by McGraw (1966) as a feedback device and a method for observing student teachers. He was primarily interested in non-verbal behaviors which he labeled "attending behavior." Various cues were isolated and their recognition taught to the student teachers through examination of the filmed record of their classes, all this in an effort to sensitize the teacher rapidly to the cues. According to McGraw the attending behaviors of individual students correlated well with their class achievement.

Johnson (1967), using video-tape programming to train student teachers to assess classroom behavior, found that trained observers did well on subsequent analysis of their own recorded classrooms but that untrained observers did not.

The Computer as a Feedback Source

As yet, the computer has been only minimally employed as a feedback device for teachers. Systems Development Corporation has constructed an automated classroom called CLASS which allows students to interact with an individual course of programmed instruction and also privately with the teacher. In this system the teacher is the "trouble-shooter" and intervenes when the programming proves to be inadequate for the student.

Baker (1963) assigns the computer several roles in educational research: (a) simulation in such areas as learning and problem solving, behavior in social groups, personality, and administration, (b) pattern recognition of data, (c) automated classrooms like CLASS, (d) information storage and retrieval, and (e) theory development.

For Taylor (1967), several aspects of human interaction with the computer constitute problems for research: (a) the internal representation of a problem within the machine, (b) the nature of the surface structure by which man and computer interact, and (c) the use of this interaction to solve problems. He finds that little work has been done on the third area.

The computer has been used for data analysis and computer simulation of cognitive processes (Feldman, 1962), business simulation (Sprowls, 1963), simulation of international relations and diplomacy (Benson, 1962), organization theory (Rome & Rome, 1962) and nerve-net simulation (Culbertson, 1962).

Mayzner, Tressalt, and Helfer (1967) suggested lines of research on the optimal characteristics of visual display for man-machine interaction: (a) types of display, (b) the order, (c) the rate of presenting information, (d) the size of the display and its inputs to the observer, (e) the intensity of illumination, (f) the spacing, (g) number, and (h) content of inputs.

In some studies computers appear as experimenters. The machine selects the stimuli, presents them to the subjects, and records and analyzes the responses. Cooperband (1966) described such an experiment in perception and discussed the advantages and disadvantages of his computerized system. Videback and Bates (1966) studied verbal conditioning in this way, with the computer programming reinforcement of correct responses.

McCandless and Best (1964) conducted an experiment in age differentiation in response to auditory stimuli. The computer provided immediate output describing response patterns of various age groups when the stimuli were varied around four parameters. Johnson (1967) used the computer as the experimenter in problem-solving experiments.

Education has begun to expand the use of computer-assisted instruction (CAI). A review and discussion of this area is presented by Hansen (1966). The classroom computer has been most popular in mathematics and business education, areas that are primarily concerned with the computational aspects of the computer (Riedesel & Suydam, 1967).

The use of the computer for test administration and for bookkeeping tasks such as recording attendance and grades and scheduling classes seems to be the first time-saving contribution that educators have investigated. CAI systems in many subject areas for different educational levels are currently receiving attention. Though a program to simulate small-group behavior is available, the computer has not, to the reviewers' knowledge, been used to enhance training. That such a use of the computer is feasible is suggested by the program described by Bellman, Friend, and Kurland (1966), who attempted to train students to conduct initial psychiatric interviews. The capabilities of computers for rapid analysis and summarization of data imply their possible usefulness as feedback devices for teacher behaviors. Such utilization has promise for supplying teachers in training with instantaneous feedback of relevant variables while eliminating the tedium of coding, analyzing, and summarizing data collected through existing analytical systems.

D. Summary and Conclusions

This preliminary review of the literature has revealed relatively few attempts at systematically improving teacher education programs in special education. The reviewers were unable to discover accounts of special education training programs with clearly defined objectives and methods designed to modify teacher behavior. Although many systems of classroom analysis have been developed by general educators, their use in teacher education is currently limited by a characteristic delay of feedback to the trainee and by the tedium of coding, summarizing, and analyzing the data collected. No system among those reviewed drew upon an analysis of special educational techniques so as to incorporate the specific characteristics of the pupils into the system. Computers are beginning to be used more frequently in education and training but we have found no reports of the use of computers in a cybernetic system for the analysis and feedback of teacher-pupil behaviors in the classroom. The present review suggests the need for the development of a Computer Assisted Teacher-Training System (CATTS). It is toward this objective that the senior reviewer and his associates at the Center for Research on Language and Language Behavior, University of Michigan, are currently working.

References

Allen, D. W., & Ryan, K. A. A new face for supervision. Stanford, Calif.: Stanford University, 1965 (mimeo).

Amidon, E. J., & Giamatteo, M. The verbal behavior of superior teachers. Elementary School Journal, 1965, 283-285.

Amidon, E. J., & Flanders, N. A. The role of the teacher in the classroom. Minneapolis, Minn.: P. S. Amidon, 1963.

Amidon, E. J., & Hunter, E. Verbal interaction in the classroom: The Amidon system of interaction analysis. Philadelphia, Pa.: Temple University, Project on Student Teaching, undated (mimeo).

Anderson, C. C., & Junka, S. M. Teacher education: Some problems and a proposal. Harvard Educational Review, 1963, 33, 1-22.

Anderson, H. H. Domination and social integration in behavior of kindergarten children and teachers. Genetic Psychology Monograph, 1939, 3, 285-385.

Aschner, M. J. The analysis of verbal interaction in the classroom. In A. A. Bellack (Ed.), Theory and research in teaching. New York: Columbia University, Bureau of Publications, Teachers College, 1963. Pp. 53-78.

Aschner-Gallagher system for classifying thought processes in the content of classroom verbal interaction. Urbana, Ill.: University of Illinois, 1965.

Badt, M. Attitudes of university students toward exceptional children. Exceptional Children, 1957, 23, 286-290.

Baker, F. B. Uses of computer in educational research: Non-computational uses of computers. Review of Educational Research, 1963, 33, 568-572.

Bales, R. F. Interaction process analysis. Cambridge, Mass.: Addison-Wesley, 1951.

Barker, R. G., Wright, B. A., Meyerson, L., & Gonick, M. R. Adjustment to physical handicap and illness: A survey of the social psychology of physique and disability. (2nd ed.) New York: Social Science Research Council, Bulletin 55, 1953.

Barr, A. S., et al. The measurement of teaching ability. Madison, Wisc.: Dunbar Publications, 1945.

Barr, A. S., et al. Wisconsin studies of the measurement and prediction of teacher efficiency. Journal of Experimental Education, 1961, 30, 5-156.

Becker, W. C., Madsen, C. H., Jr., Arnold, C. R., & Thomas, D. R. The contingent use of teacher attention and praise in reducing classroom behavior problems. Journal of Special Education, 1967, 1, 287-307.

Bellack, A. A., Hyman, R. T., Kliegard, K. M., & Smith, F. L. The language of the classroom. Part II. New York: Columbia University, Teachers College, Institute of Psychological Research, Cooperative Research Project No. 2023, 1965.

Bellman, R., Friend, M. B., & Kurland, L. Simulation of the initial psychiatric interview. Behavioral Science, 1966, 11, 389-399.

Benson, O. Simulation of international relations and diplomacy. In H. Borko (Ed.), Computer applications in the behavioral sciences. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962. Pp. 574-595.

Bernstein, B. Social class and linguistic development: A theory of social learning. In A. H. Halsey, Jean Floud, & C. A. Anderson (Eds.), Education, economy and society. New York: Free Press, 1961. Pp. 288-314.

Blatt, B. The measurement and modification of the behavior of teachers. Paper read at the Council for Exceptional Children, Kansas City, May, 1964.

Blatt, B. The preparation of special education personnel. Review of Educational Research, February, 1966, 151-159.

Borg, W. A. The minicourse: Rationale and uses in in-service education of teachers. Paper delivered at AERA Conference, Chicago, Illinois, 1968.

Borko, H. (Ed.) Computer applications in the behavioral sciences. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962.

Bruner, J. S. The process of education. Cambridge, Mass.: Harvard University Press, 1963.

Cain, L. F. Special education moves ahead: A comment on the education of teachers. Exceptional Children, 1964, 30, 211-217.

Cain, L. F., & Levine, S. A study of the effects of community and institutional school classes for trainable mentally retarded children. San Francisco: San Francisco State College, 1961.

Cain, L. F., & Levine, S. The mentally retarded. Review of Educational Research, 1963, 33, 67-82.

Cawley, J. F. Selected characteristics of individuals oriented toward mental retardation. Paper read at the Council for Exceptional Children, Chicago, April, 1964.

Cawley, J. F., & Chase, D. V. Productive thinking in retarded and non-retarded children. Unpublished manuscript, University of Connecticut, 1966.

Computer model for clinical diagnostic theory. Archives of General Psychiatry, 1967, 17, 498-505.

Conant, J. B. The education of American teachers. New York: McGraw-Hill, 1963.

Condell, J. F., & Tonn, M. H. A comparison of MTAI scores. Mental Retardation, 1965, 3, 23-24.

Connor, F. P., & Goldberg, I. Opinions of some teachers regarding their work with trainable children: Implications for teacher education. American Journal of Mental Deficiency, 1960, 64, 658-670.

Cooperband, A. S. The use of a computer in conducting psychological experiments. Behavioral Science, 1966, 11, 307-311.

Coulson, J. E. Effects of branching in a computer controlled autoinstructional device. Journal of Applied Psychology, 1962, 46, 389-392.

Cruickshank, W. M. Current educational practices with exceptional children. In W. M. Cruickshank & G. O. Johnson (Eds.), Education of exceptional children and youth. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1967. Pp. 468-489.

Culbertson, J. T. Nerve net theory. In H. Borko (Ed.), Computer applications in the behavioral sciences. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962.

DeViney, R. D. An evaluation of closed-circuit television observation for students taking certain courses in elementary education. Dissertation Abstracts, 1963, 23, 3198-3199.

Davis, O. L., & Tinsley, D. C. Cognitive objectives revealed by classroom questions asked by social studies student teachers. In R. T. Hyman (Ed.), Teaching: Vantage point for study. New York: J. B. Lippincott, 1968. Pp. 140-146.

Feldman, J. Computer simulation of cognitive processes. In H. Borko (Ed.), Computer applications in the behavioral sciences. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962. Pp. 336-359.

Fine, M. J., Allen, C. A., & Medvene, A. M. Verbal interaction patterns in regular and special classrooms. Paper presented at the AAMD Annual Meeting, Denver, Colorado, 1967.

Flanders, N. A. Analyzing teacher behavior. Educational Leadership, 1961, 19, 173-175; 180-200.

Flanders, N. A. Using interaction analysis in the inservice training of teachers. Journal of Experimental Education, 1962, 30, 313-316.

Flanders, N. A. Intent, action and feedback: A preparation for teachers. Journal of Teacher Education, 1963, 14, 251-260.

Flanders, N. A. Interaction analysis in the classroom: A manual for observers. Ann Arbor: University of Michigan, School of Education, 1964.

Flanders, N. A. Teacher influence, pupil attitudes and achievement. U. S. Department of Health, Education & Welfare, Office of Education, Cooperative Research Monograph No. 12, Final Report. Washington, D. C.: Government Printing Office, 1965.

Fliegler, L. A. Teacher education. Education and Training of the Mentally Retarded, 1966, 1, 38-39.

Fouracre, M. H. Student teaching in the professional preparation of the teacher of the mentally retarded, Education and Training of the Mentally Retarded, 1966, 1, 145-149.

Fuchigami, R. Y. Training critic teachers in special education. Education and Training of the Mentally Retarded, 1967, 2, 142-146.

Gage, N. L. Handbook of research on teaching. Chicago, Ill.: Rand McNally & Co., 1963.

Gallagher, J. J. Productive thinking of gifted children. U. S. Department of Health, Education, and Welfare, Office of Education, Cooperative Research Project No. 965. Urbana: University of Illinois, College of Education, Institute for Research on Exceptional Children, 1965.

Gallagher, J. J. Special education in 1977: The projection of trends. Paper prepared for Council for Exceptional Children for use in Conference on Uses of Satellites in Education, Washington, D. C., January, 1967.

Galloway, C. M. Nonverbal communication in teaching. In R. T. Hyman (Ed.), Teaching: Vantage points for study. New York: J. B. Lippincott, 1968. Pp. 70-77.

Garrison, K. C., & Scott, M. H. A comparison of the personal needs of college students preparing to teach in different teaching areas. Educational and Psychological Measurement, 1961, 21, 955-964.

Gottfried, N. W., & Jones, R. L. Career choice factors in special education. Exceptional Children, 1964, 30, 218-223.

Hansen, D. N. Computer assistance with the educational process. Review of Educational Research, 1966, 36, 588-603.

Heathers, G. Team teaching and the educational reform movement. In J. T. Shaplin & H. F. Olds, Jr. (Eds.), Team Teaching. New York: Harper & Row, 1964. Pp. 345-375.

Heber, R. F. The educable mentally retarded. In S. A. Kirk & B. Weiner (Eds.), Behavioral research on exceptional children. Washington, D. C.: Council for Exceptional Children, 1963.

Heller, H. W. The relationship between certain background characteristics of special education teachers and their decision to leave special education. Unpublished doctoral dissertation, Colorado State College, 1961.

Hillson, M. (Ed.) Change and innovation in elementary school organization: Selected readings. New York: Holt, Rinehart and Winston, 1965.

Hudson, M. Procedures for teaching trainable children. Council for Exceptional Children Research, 1960(Monograph No. 2, Series A).

Hughes, M. M. Assessment of the quality of teaching in elementary schools. Salt Lake City: University of Utah, Cooperative Research Project No. 353, 1959.

Hughes, M. M. What is teaching? One viewpoint. Educational Leadership, 1962, 19, 251-259.

Hurley, O. L. Teacher language: Key to learning? Education and Training of the Mentally Retarded, 1967, 2, 127-133.

Johnson, E. S. Computers in behavioral science: The computer as experimenter. Behavioral Science, 1967, 12, 484-489.

Johnson, M. R. An experimental investigation of some dimensions underlying preferences for teaching exceptional children. Unpublished master's thesis, Fisk University, 1964.

Johnson, R. B. Product research: Teacher training by programmed videotapes. Dissertation Abstracts, 1967, 27, 3757A-3758A.

Johnson, W., Darley, F. L., & Spriesterbach, D. C. Diagnostic methods of speech pathology. New York: Harper & Row, 1963.

Jones, R. L., & Gottfried, N. W. Preferences and configurations of interest in special class teaching. Exceptional Children, 1962, 28, 371-377.

Jones, R. L., & Gottfried, N. W. Psychological needs and preferences for teaching exceptional children. Exceptional Children, 1966, 32, 313-321.

Keppel, F. Master of arts in teaching. Saturday Review, 1961, 44, 63-65.

Lance, W. D. School programs for the trainable mentally retarded. Education and Training of the Mentally Retarded, 1968, 3, 3-11.

Lewin, K., Lippitt, R., & White, R. K. Patterns of aggressive behavior in experimentally created "social climates." Journal of Social Psychology, 1939, 10, 271-299.

Lieman, J. M. The language of individual instruction: A study of the structure and pattern of discourse in teaching homebound pupils. Outline for a doctoral dissertation, Teachers College, Columbia University, 1966.

Lord, F. E., & Wallace, H. W. Recruitment of special education teachers. *Exceptional Children*, 1949, *15*, 171-173.

MacDonald, J. B., & Zaret, E. A study of openness in classroom interaction. In R. T. Hyman (Ed.), *Teaching: Vantage points for study*. New York: J. B. Lippincott, 1968. Pp. 197-205.

McCandless, G. A., & Best, L. Evoked responses to auditory stimuli in man using a summing computer. *Journal of Speech and Hearing Research*, 1964, *7*, 193-202.

McGraw, F. M., Jr. The use of 35mm time-lapse photography as a feedback and observation instrument in teacher education. *Dissertation Abstracts*, 1966, *26*, 6533-6534.

Mackie, R. P., Dunn, L. M., & Cain, L. F. *Professional preparation for teachers of exceptional children*. *An overview.* Washington, D. C.: U. S. Government Printing Office, 1960.

Mackie, R. P., Williams, H. W., & Dunn, L. M. *Teachers of children who are mentally retarded*. U. S. Department of Health, Education and Welfare, Office of Education, Bulletin 1957, No. 11. Washington, D. C.: Superintendent of Documents, Government Printing Office, 1957.

Mayzner, M. S., Tressalt, M. E., & Helfer, M. S. A research strategy for studying certain effects of very fast sequential input rates on the visual system. *Psychological Monographs Supplement*, 1967, *2*, 73-81.

Means, M. H. Fears of one thousand college women. *Journal of Abnormal and Social Psychology*, 1936, *31*, 291-311.

Medley, D. M., & Mitzel, H. E. Measuring classroom behavior by systematic observation. In N. L. Gage (Ed.), *Handbook of research on teaching*. Chicago: Rand McNally & Co., 1963. Pp. 247-328.

Meier, J. H. Rationale for and application of micro-training to improve teaching. Paper delivered at AERA Conference, Chicago, Ill., 1968.

Meir, W. H. Visual feedback as a means of influencing teacher behavior. *Dissertation Abstracts*, 1967, *27*, No. 4136A.

Meisgeier, C. The identification of successful teachers of mentally or physically handicapped children. *Exceptional Children*, 1965, *32*, 229-235.

Meyers, C. E. Realities in teacher recruitment. *Mental Retardation*, 1964, *2*, 42-46.

Mijer, O. H. A study of the use of tape recordings as a substitute for classroom observations in teacher education. *Dissertation Abstracts*, 1964, 25, 2367-2368.

Minnis, D. L. Micro-teaching and interaction analysis in a teacher education curriculum. Paper delivered at the AERA Conference, Chicago, Ill., 1968.

Minskoff, E. H. An analysis of the teacher-pupil verbal interaction in special classes for the mentally retarded. Unpublished doctoral dissertation, Yeshiva University, New York. Office of Education, U. S. Department of Health, Education, and Welfare, Project No. 6-8092, Grant No. 32-42-1700-6008, 1967.

Mullen, F., & Itkin, W. *Achievement and adjustment of educable mentally handicapped children in special classes and in regular grades*. Chicago: Board of Education, 1961.

Murray, H. M. *Exploration in personality*. New York: Oxford University Press, 1938.

Mussen, P. H., & Barker, R. G. Attitudes toward cripples. *Journal of Abnormal Psychology*, 1944, *39*, 351-355.

Olivero, J. L. Video recordings as a substitute for live observations in teacher education. *Dissertation Abstracts*, 1965, *25*, 5769-5770.

Olson, J. L., & Hahn, H. R. Our approach to preparing teachers of the mentally retarded. *High School Journal*, 1964, *48*, 191-197.

Perkins, H. V. A procedure for assessing the classroom behavior of students and teachers. *Journal of American Educational Research*, 1964, *1*, 249-260.

Philippus, M. A. A study of personality, value and interest patterns of student teachers in the areas of elementary, secondary and special education. Unpublished doctoral dissertation, University of Denver, 1961.

Pierce, G. Principals' perceptions of defined reinforcement behaviors of selected teachers of culturally divergent students. (WSU, 1966) *Dissertation Abstracts*, 1967, *27*, 2339A-2340A.

Rich, A. L. The status of teachers of the educable mentally retarded. Unpublished doctoral dissertation, University of Pittsburgh, 1960.

Riedesel, C. A., & Suydam, M. N. Computer-assisted instruction: Implications for teacher education. *Arithmetic Teacher*, 1967, *14*, 24-29.

Roberts, J. E. An investigation of selected personality variables among elementary, secondary, and special education teachers. Unpublished doctoral dissertation, University of Denver, 1962.

Rome, S. C., & Rome, B. K. Computer simulations toward a theory of large organization. In H. Borko (Ed.), Computer applications in the behavioral sciences. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962. Pp. 522-555.

Rosenberg, M., Glueck, B. C., Jr., & Bennett, W. L. Automation of behavioral observations on hospitalized psychiatric patients. American Journal of Psychiatry, 1967, 123, 926-929.

Rusalem, H. The environmental supports of public attitudes toward the blind. Outlook for the Blind, 1950, 44, 277-288.

Rusk, H. A., & Taylor, E. J. New hope for the handicapped. New York: Harper, 1946.

Sanders, N. M. Classroom questions: What kinds? New York: Harper & Row, 1966.

Sarason, S. B., Davidson, K., & Blatt, B. The preparation of teachers: An unstudied problem in education. New York: John Wiley, 1962.

Schwartz, L. An integrated teacher education curriculum for special education - A new approach. Exceptional Children, 1967, 33, 411-416. (a)

Schwartz, L. Preparation for the clinical teacher for special education: 1866 - 1966. Exceptional Children, 1967, 34, 117-124. (b)

Semmel, M. I. Teacher attitudes and information pertaining to mental deficiency. American Journal of Mental Deficiency,1959, 53, 566-574.

Semmel, M. I., Herzog, B., Kreider, J., & Charves, M. Analysis of verbal interaction patterns in classes for the mentally retarded. In H. L. Lane & E. M. Zale (Eds.), Studies in language and language behavior, IV. Ann Arbor: University of Michigan, Center for Research on Language and Language Behavior, U.S.O.E. Contract No. OEC-3-6-061784-0508, 1967.

Semmel, M. I., Herzog, B., & Jorgenson, F. A pilot study of the verbal interaction of regular elementary classes and special classes for the educable mentally retarded. In H. L. Lane (Ed.), Studies in language and language behavior, I. Ann Arbor: University of Michigan, Center for Research on Language and Language Behavior, U.S.O.E. Contract OE-5-14-036, 1965.

Shane, D. G., & Shane, J. S. Inservice training for special education teachers. Education and Training of the Mentally Retarded, 1967, 2, 202-207.

Shaplin, J. T., & Olds, H. F., Jr. (Eds.) Team teaching. New York: Harper & Row, 1964.

Shriner, T. H. A comparison of selected measures with psychological scale values of language development. Journal of Speech and Hearing, in press.

Silberman, H. F. A computer controlled teaching machine. Behavioral Science, 1961, 6, 259-261.

Smith, B. O., & Meux, M. O. A study of the logic of teaching. USOE Cooperative Research Project No. 258. Urbana, Ill.: University of Illinois, 1962.

Smith, R. M. Clinical teaching: Methods of instruction for the retarded. New York: McGraw Hill, 1968.

Sparks, H. L., & Blackman, L. S. What is special about special education revisited: The mentally retarded. Exceptional Children, 1965, 31, 242-247.

Springman, D. B. Secondary-teacher majors: Classroom observations by audio-video tape devices. Dissertation Abstracts, 1966, 27, 87A-88A.

Sprowls, R. C. Business simulation. In H. Borko (Ed.), Computer applications in the behavioral sciences. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962. Pp. 556-573.

Stigall, T. T. Investigations in psychotherapy and verbal conditioning with conjugatively programmed social reinforcement. Dissertation Abstracts, 1966, 27, 1631B-1632B.

Taba, H., Levine, S., & Elzey, F. Thinking in elementary school children. San Francisco, California: San Francisco State College, USOE Cooperative Research Project No. 1574, 1964.

Taylor, R. W. Man-computer input-output techniques. IEEE Transactions on Human Factors in Electronics, 1967, 8(1), 1-4.

Teacher education programs. In Council for Exceptional Children Committee, Professional Standards for Personnel in the Education of Exceptional Children. Washington: CEC, 1966. Pp. 8-11.

This is CLASS (Computer-based Laboratory for Automated School Systems). Phi Delta Kappan, 1962, 43, 348-350.

Trump, J. L. Images of the future - Guide to better schools. Washington, D. C.: National Association of Secondary School Principals, 1958.

Videback, R., & Bates, H. D. Verbal conditioning by a simulated experimenter. Psychological Record, 1966, 16, 145-152.

Warburton, F. W. Educational psychology. Annual Review of Psychology, 1962, 13, 317-414.

White, B. Computer applications to psychological research: Studies in perception. Behavioral Science, 1962, 7, 396-401.

Willman, C. E. A comparison of prospective special education and elementary teachers on selected personality characteristics. Unpublished doctoral dissertation, University of Michigan, 1966.

Withall, J. An objective measurement of a teacher's classroom interaction. Journal of Educational Psychology, 1956, 47, 203-212.

Wolinsky, G. F. Theoretical and practical aspects of a teacher education program for teachers of the trainable child. American Journal of Mental Deficiency, 1959, 63, 948-953.

Chapter VII

CONNOTATIVE MEANING OF DISABILITY LABELS UNDER STANDARD AND AMBIGUOUS TEST CONDITIONS

Melvyn I. Semmel
Center for Research on Language and Language Behavior
The University of Michigan

50 graduate students were administered a scale designed to test the connotative meaning of different disability labels along a comfort-discomfort continuum. Following standard administration, Ss were asked to repeat their responses without the original scale items (ambiguous condition). The effect on scores arising from individual differences in interpreting scale anchors was estimated and partialled out. Corrected scores were found to be relatively stable when the results of the first and second test conditions were compared. The data were interpreted as offering no support for the claim that ambiguous test conditions (as defined in this study) tend to increase socially acceptable response sets.

Results under standard conditions were analyzed to determine the validity of the hypothesis that connotative reactions to disability labels produce an invariant rank ordering of labels along a comfort-discomfort continuum. Data from previous research were partially confirmed under both the ambiguous and standard testing conditions used in this study. The cultural uniformity hypothesis gains additional support from the results of this investigation.

Semmel and Dickson (1966) attempted to develop a method for determining connotative reactions to different disability labels and one racial label (Negro) in described situations that varied in the degree of implied personal involvement. The scale developed yielded responses to each label along a comfort-discomfort continuum for each situation, and a total scale score for all disability labels across items. Significant differences between labels were reported. The authors postulated that the results reflected a culturally determined hierarchy in the connotative meaning of disability labels.

Several writers have expressed concern for the effect of response biases and sets on the validity of measures (Cronbach, 1946; 1950). It is the general consensus that response biases are most operative under relatively unstructured or ambiguous testing conditions.

The present study was designed to explore the connotative meaning of disability labels under standard and ambiguous testing conditions. The ambiguous condition was defined by the absence of test items in the presence of labels. Ss were asked to recall their responses to all items for each label completed under the previously administered standard test conditions. It was predicted that the ambiguous condition would produce response sets reflected in an increment in mean total label score when compared to total label scores obtained from the standard test condition--but the rank order of individual label scores was not expected to differ.

A feature of the present study was the elimination of response sets associated with differential interpretations of scale anchors. It was felt that responses to disability labels are made by Ss using a "normal" frame of reference. By obtaining responses to a "Normal" (N) label, it was possible to appraise directly the meanings attributed to anchors by Ss, and thus to correct all responses to disability labels by centering them around the N label score. This technique had the effect of partialling out the individual difference effects of semantic response sets to scale anchors for all test items.

Finally, the investigation was designed to obtain additional data on the relative position of disability labels along a comfort-discomfort continuum. It was hypothesized that the results obtained in earlier research (Semmel & Dickson, 1966) would be reproduced under both standard and ambiguous test conditions. Specifically, it was expected that the rank order of disability labels along the comfort-discomfort continuum would remain invariant under both conditions when compared to earlier findings.

Method

Subjects. Ss were 50 graduate students enrolled in the Departments of Special Education and Psychology at George Peabody College for Teachers. All Ss were candidates for advanced graduate degrees. The departments conduct considerable scholarly and research activity on topics related to handicapped children. All Ss took the Miller Analogies Test and the Graduate Record Examination upon entering graduate school. Since their admission in the school was contingent upon relatively high percentile ranks on these examinations, it was assumed that the group was relatively homogeneous and superior in general intelligence.

Instrument. A revision of the SAQ scale developed by Semmel and Dickson (1966) was used to collect the data for this study. The revised scale consists of 20 items of implied social-psychological situations demanding various degrees of interaction with persons identified by disability labels. Items ranged from:

"How would you feel about talking in public with each of the persons listed?" to "How would you feel about marrying each of the persons listed?" *Ss* responded to each item 12 consecutive times with reference to 12 labels before passing on to the next item. The labels used were Epileptic (*E*), Mentally Retarded (*MR*), Blind (*B*), Cerebral Palsied (*CP*), Gifted (*G*), Negro (*NE*), Crippled (*C*), Emotionally Disturbed (*ED*), Deaf (*D*), Amputee (*A*), Normal (*N*), and Stutterer (*S*). The revised SAQ scale differed from the original instrument in three ways: (a) the key was expanded from 3 to 5 scale anchors; (b) the number of items was increased from 10 pairs of parallel items to 20 unparallel items; (c) the number of labels was increased to 12 from the original 8 by the addition of labels *G*, *C*, *ED*, and *A*. The expanded number of items and scaling points was expected to improve sub-scale and total scale reliabilities. The increase in the sample of items further strengthens the rational argument for the content validity of the revised instrument.

The revised scale produce 12 sub-scale scores (SS) for respective labels and a total scale score (TS). SS scores were obtained by summing across items for each label. Responses to all items were made along a 5-point continuum (Very Comfortable-VC, Comfortable-C, Indifferent-I, Uncomfortable-U, and Very Uncomfortable-VU). Weights were assigned to each scale anchor such that VU=1, U=2, I=3, C=4, VC=5. To partial out the effect of semantic response sets in interpreting scale anchors, raw scores were corrected according to the following formula:

$$\text{(1)} \qquad \text{CSS} = \frac{(10)\ \Sigma X_i}{\Sigma X_n}$$

where CSS is the Corrected Sub-Scale score for any label, ΣX_i is the sum of weighted raw scale points across items for the *i*th label, and ΣX_n is the sum of weighted raw scale points across items for the *N* label.
The total scale scores (CTS) were obtained by summing across CSS scores and subtracting the CSS score for the *N* label. Formula (1) assumes that all *Ss* utilize the normal frame of reference in making judgments about disability labels. Thus, anchors used for *N* sub-scale were used to estimate *S*'s response set in interpreting scale anchors.

Two label sub-scales were included in the CTS scores although they are not usually considered disability labels: Gifted (*G*) and Negro (NE). The *G* label scores were included as a referent in interpreting CSS results. The *G* CSS scores were assumed to produce levels equal to or greater than the *N* CSS scores. A further assumption was that the variance contributed to CTS by *G* would be minimal; the inclusion of the *G* sub-scale would add a constant to the total scores without changing their relative values. The NE scores were included as a test of the prevalent hypothesis that reactions to disability groups are similar to those toward religious and racial minority groups in our society (Wright, 1960). It was assumed that the NE label sub-scale would contribute significant variance to the total scores. Therefore, the CTS scores were interpreted with the understanding that the NE label functions as a disability label.

Procedure. Ss were each given a copy of the revised SAQ and a special answer sheet. E read the directions, which were also printed on the front page of the questionnaire,

> We are interested in different people's feelings about doing things with other people. We would appreciate your candid responses to the accompanying questionnaire. Your responses will remain anonymous. Please do not write your name or any identifying marks on your answer sheet. There are 20 questions in this questionnaire. You are asked to respond to each question separately by indicating a response for each of 12 types of people listed on your answer sheet. In making your responses, please follow these directions carefully.
>
> 1. Read the first question carefully.
> 2. Read the 12 words or phrases listed on your answer sheet.
> 3. Respond to the column provided for the question. Use the following key in making responses: (The response key was then read orally while Ss read it silently at their seats).
> 4. Follow the above procedure for all remaining questions.
> 5. Remember: respond to each listing for a question before moving on to the next question.
> 6. Work as rapidly as possible always working down the column (E illustrated with answer sheet) designated for the question on your answer sheet.
> 7. We are interested in your first response to each item. Therefore, please do not erase any responses.

Ss were asked if they had any questions but they had none. E then asked Ss to place a number in the upper right hand corner of the answer sheet that only they would be able to identify. E then said,

> Please turn the page and begin with question #1. You may work at your own rate of speed--but try to move along as rapidly as you can. When you finish put your answer sheet under your seat and wait for the others to finish. (Ss appeared to have no difficulty in understanding the instructions.)

E moved about the room to make certain that all Ss were completing the task correctly. All Ss completed the task within 20 minutes. A second blank answer sheet was then distributed to Ss. E said, "Please put the number you used on the first answer sheet on this second answer sheet."

> We are now interested in how well you can remember the responses you used on the first sheet. You will remember that on the first sheet you worked down the page (demonstrating), now try to remember what you put in each of the boxes but instead of working down the sheet, work across the sheet. For example, the first word on your sheet is Epileptic. Try to remember the 20 responses you gave across the sheet. Then go on to the next word and do the same. Continue until you have a response for each box on your sheet. We do not expect you to remember all of the responses, but make certain you put a response in each box anyway. Are there any questions?

Several Ss complained that the task was too difficult. They indicated their displeasure by their expression and by their murmuring. E responded to complaints with, "Do the best you can." After approximately 1 minute, E said, "You may take as much time as you wish on this second part--but please try to work as rapidly as is comfortable for you. You may begin." Ss began to work with no apparent difficulties; inter-subject communication immediately ceased and test conditions comparable to those during the standard administration phase were quickly established. Ss took approximately 20 minutes to complete this second part of the task.

Results

A matched-pairs t test was computed to determine the significance of difference between CTS scores obtained from the standard conditions (SC) and the ambiguous condition (AC). A mean difference of .32 yielded a $t = .31$, which was insufficient to reject the null hypothesis ($p > .05$). It was concluded that CTS score differences between tests were not significantly different from chance expectancy. The SC yielded a mean CTS = 90.80, $SD = 11.50$. The AC resulted in a mean CTS = 90.92, $SD = 13.99$. The correlation between SC and AC CTS scores was $r = .58$ ($p < .05$).

A Subjects x Treatments analysis of variance design was used to determine the difference between mean CSS scores under SC. Hartley's F max test was used to test the assumption of homogeneity of variance for the ten subscale distributions used in this analysis. The Normal and Gifted label CSS scores were omitted from the analysis of variance. The Cerebral Palsied CSS score distribution yielded a maximum Variance = 3.64, while the Stutterer CSS distribution yielded a minimum Variance = .97. The resulting variance ratio produced F max = 3.75. This value represents a small but significant departure from the homogeniety of variance assumption (Min. Var. = 95, $df = 49$,

$\underline{k}$ = 10, $\underline{F}$ max = 3.29). Following Lindquist (1953, p.86), a higher "apparent" level of significance was adopted. All tests of significance were tested at the .01 level and are reported here at the .05 level. Table 1 summarizes the results of the variance analysis. It will be noted that significance between labels and between S variance ratios was obtained. A critical difference (d) was computed to determine which mean CSS scores differed significantly. Table 2 summarizes respective d values.

Insert Tables 1 and 2 About Here

The last line in Table 2 shows the mean CSS scores for all label subscales. For comparative purposes, the mean CSS scores for the Normal and Gifted labels are included. Ranking the mean scores resulted in the following order, from high to low along the comfort-discomfort continuum: G, N, S, D, C, A, B, NE, E, MR, ED, CP. It can be noted further from Table 2 that there is no significant difference between the mean scores of the first two ranks (G and N); between ranks 3 through 7 (S, D, C, A, B); between ranks 8 through 10 (NE, E, MR); and no difference between ranks 11 and 12 (ED, CP).

Seven label CSS score means were extracted from the data collected in the present study and separately ranked for the purpose of comparing results with those previously reported by Semmel and Dickson (1966). Table 3 shows the ranked labels obtained from four sub-populations and the data from the present study.

Insert Table 3 About Here

Discussion

The ambiguous testing conditions (viz., the absence of items) following standard test conditions resulted in little change in the central tendency or variance of total connotative reactions to disability labels (CTS). There appears to be a moderately high correlation between performance under the two test conditions. These results do not support the contention that ambiguous test conditions, as defined here, produce greater socially acceptable response sets. Memory alone cannot account for these results: the number of items and anchors used in the standard condition renders such an explanation highly improbable. It will be recalled that Ss were not informed that they would be asked to duplicate their initial responses until they had completed the first phase of the task and had placed their answer sheet out of sight. Subjective comments from Ss also indicated that they did not remember the specific items of the scale.

The results suggest that Ss responded to the items under the standard condition in accordance with true response tendencies to stimulus cues (labels). Thus, summing across items and partialling out the effects of differential semantic sets in interpreting scale anchors resulted in obtaining a relatively accurate estimate of Ss' commonality vis-a-vis the trait under investigation (connotative meaning of disability labels). When faced with the ambiguous condition which demanded the reproduction of responses without specific samples (items) from the universe of possible items subsumed by the trait, Ss probably projected their generalized reaction to the respective labels. These reactions represent the commonality estimate which was sought in applying an additivity model to the CSS scores obtained under the standard condition. In reacting to the labels under both conditions, Ss probably utilized the entire array of labels in such a way that their responses would fall into a subjectively logical rank ordering. The relative invariance of the hierarchy of labels found between the two conditions in the present study and in comparison with previously reported data supports this interpretation. The results therefore confirm the position postulated by the author (Semmel & Dickson, 1966)--that there exists an invariant hierarchy of connotative meaning assigned to disability labels by non-disabled groups within our society.

To be sure, the ambiguous condition did not perfectly reproduce the rank order obtained in the standard condition, but the differences are more likely the result of a measurement error than of a defect in the cultural uniformity hypothesis. Differences in rank order occurred only with a few labels which fell relatively close together and toward the center of the comfort-discomfort continuum. The scales used were probably not sensitive enough to differentiate such small differences under the two conditions.

The results showing relative scale position of the Negro label offer further support for the contention that racial and religious minority labels evoke affective responses similar to those associated with disability labels.

Semmel and Dickson (1966) reported a low but significant correlation between Pr scale scores of the MMPI and SAQ disability-label responses of college undergraduates. Further research should verify this finding by indicating significant covariation between specific disability-label reactions and generalized attitudes toward racial and religious minorities.

The cross validation of the hierarchy hypothesis points the way to further research into the connotative meaning conveyed by different disability labels. The results of this and previous investigations suggest the utility of searching for factors associated with the overlapping clusters of labels identified. A factor analysis of connotative responses of a large heterogeneous population to a wide variety of labels denoting disability is a logical next step toward fuller understanding of the signification of such labels through the study of their connotative meanings.

References

Cronbach, L. J. Response sets and test validity. Educational and Psychological Measurement, 1946, 6, 475-494.

Cronbach, L. J. Further evidence on response sets and test design. Educational Psychological Measurement, 1950, 10, 3-31.

Lindquist, E.F. Design and analysis of experiments. New York: Houghton Mifflin, 1953.

Semmel, M. I., & Dickson, S. Connotative reactions of college students to disability labels. Exceptional Children, 1966, 32, 443-450.

Wright, B. A. Physical disability: A psychological approach. New York: Harper & Row, 1960.

Table 1

Analysis of Sub-Scale Scores Under the Standard Test Condition

Source	df	Mean Squares	F
Between labels	9	23.352	69.916*
" subjects	49	19.771	59.194*
Labels x Subjects	441	.334	------
Total	499		

*Significant at < .01 level.

Table 2

Summary of Critical Differences Between Mean Sub-Scale Distribution Scores

Ranks

Labels	G	N	S	D	C	A	B	NE	E	MR	ED	CP
G		.03	1.06	1.45	1.50	1.51	1.69	1.80	2.07	2.76	2.98	3.10
N			1.03	1.42	1.47	1.48	1.66	1.77	2.04	2.46	2.95	3.07
S				.39	.44	.45	.63	.74	1.01	1.43	1.92	2.04
D					.05	.06	.24	.35	.62	1.04	1.53	1.65
C						.01	.19	.30	.57	.99	1.48	1.60
A							.18	.29	.56	.98	1.47	1.59
B								.11	.38	.80	1.29	1.41
NE									.27	.69	1.18	1.30
E										.42	.91	1.03
MR											.49	.61
Means	10.03	10.00	8.97	8.58	8.53	8.52	8.34	8.23	7.96	7.54	7.05	6.93
SD	.57	.00	.99	1.08	1.42	1.10	1.32	1.54	1.82	1.53	1.80	1.91

Note: Any $d > .67$ is significant at .05 level.

Abbreviations key:

G-Gifted
N- Normal
S- Stutterer
D-Deaf
C-Crippled
A-Amputee
B-Blind
NE-Negro
E-Epileptic
MR-Mentally Retarded
ED-Emotionally Disturbed
CP-Cerebral Palsied

Table 3

Comparison of Ranked Means for Seven Label Sub-Scales with Previously Reported Data Collected from Special Education and Elementary Education Undergraduate Students in a Northern City (Semmel & Dickson, 1966)

	Present Study Conditions		Semmel and Dickson (1967) Data	
Rank	Standard (SC)	Ambiguous (AC)	Sp. Ed. Undergrad.	El. Ed. Undergrad.
1	S	S	S	S
2	D	B	D	D
3	B	D	B	B
4	NE	NE	NE	NE
5	E	E	E	E
6	MR	MR	MR	MR
7	CP	CP	CP	CP

Note: Rank order from positive to negative connotative meaning (e.g., CP evoked most negative connotations).

Chapter VIII

THE INFLUENCE OF DISABILITY LABELS AND DIALECT DIFFERENCES ON THE SEMANTIC DIFFERENTIAL RESPONSES OF COLLEGE STUDENTS

Melvyn I. Semmel

Center for Research on Language and Language Behavior

The University of Michigan

Semantic differential (SD) responses of 100 college juniors following 2 structured interviews with children were assessed. The children's verbal responses were characterized by standard or non-standard (Negro) dialect. Different disability labels were assigned to each child. SD responses were made relative to children's personality, social behavior, academic and intellectual ability, and home background.

Results indicated significant differences between SD responses as a function of dialect and characteristics measured. The main effects were, however, qualified by a significant interaction between these variables. Differences between disability labels were not significant.

In a subsequent study typescripts of the two interviews were distributed to 128 college juniors. S̲s were asked to identify the "Negro" and "White" children from reading the typescripts, but were unable to do so. It was inferred that the results from the first investigation were probably produced by reactions to dialect rather than to other differences in the content of the interviews (i.e., sentence length).

While there appears to be a hierarchy of connotative reactions to verbal labels denoting disability (Semmel & Dickson, 1966), the relative effects of such labeling on evaluative behavior in the presence of minimal cues provided by the labeled subject have not been extensively investigated. Labeled children provide linguistic cues through their utterances, which may or may not confirm the validity of the label. The dialect of a labeled speaker may offer cues which interact with the label to mediate the listener's evaluative inferences about the home background, personality and academic ability of the speaker. Asch (1946), Kelley (1950) and others have demonstrated the effect of minimal cues on judgmental behavior toward others. The work reported by Lambert (1967) and Guskin (1968) exemplifies how perception of minimal linguistic cues affects judgments of personality.

The present study was designed to investigate the interactive effects of disability labels and of the dialectical features of labeled children's utterances on the evaluative inferences drawn by teachers in training about the personality, social behavior, academic intellectual ability, and home background of labeled speakers. Labels were assigned to each of two children by means of task directions read by Ss before they started listening to two tape recordings of the children engaged in a structured interview. The oral stimuli were characterized in the one case by a standard mid-western American dialect, and in the other, by a non-standard, "Negro dialect." It was hypothesized that disability labels interact with the phonological features of Negro dialect to produce relatively less positive evaluative semantic differential responses to the labeled Negro than to the labeled Caucasian child. The phonological features of dialect are viewed as powerful cues associated with intellectual, behavioral and social characteristics of a speaker. Hence, when a speaker is assigned a disability label denoting intellectual, social or emotional deviance, his dialect serves as an external source of verification either to strengthen or weaken the affective meaning of the label--which subsequently mediates evaluative inferences about the speaker.

Method

Subjects

One hundred college juniors enrolled in introductory courses in educational psychology at the University of Michigan served as Ss for the study.

Construction of Taped Interviews

Two fifth-grade boys from the same public school class were matched as closely as possible on IQ, academic ability, personality characteristics and social class background. No formal matching criteria were established other than subjective opinions of the E and of the teacher of the boys. Both children were in the fifth grade and had no history of school difficulty. John G. (Caucasian) was judged to have "normal" speech with a characteristic mid-western American accent. Monty P. (Negro) was judged to have "normal" speech with a non-standard "Southern Negro" accent.

A tape recording was made of a short structured interview (15 min.) conducted with the boys by a female graduate student using a standardized set of questions. Table 1 presents the 16 questions asked in serial order by the same interviewer to each of the two boys in separate sessions.

Insert Table 1 About Here

Analysis of the taped interviews revealed no difference in the type-token rations (TTR) of the two children's responses. The Negro boy produced a TTR = .49, the Caucasian boy a TTR = .47. The mean sentence length of the Negro boy was 6.81 (SD = 6.96), that of the Caucasian boy was 11.62 words (SD = 8.81); the difference between the means was significant ($p < .05$).

Semantic Differential

A semantic differential scale was constructed for each of four pupil-characteristics concepts: (a) Personality (14 polar items), (b) Social Behavior (7 polar items), (c) Academic and Intellectual Ability (14 polar items), and (d) Home background (7 polar items).

The five verbal labels chosen for the investigation were (a) *Orthopedically Handicapped*; (b) *Mentally Retarded*; (c) *Emotionally Disturbed*; (d) *Culturally Deprived*; (e) *Normal*. Five sets of instructions for *Ss* were constructed--each set being identical except for using one of the five labels to refer to the child heard on the tapes.

Procedure

Ss were randomly assigned one of the five sets of instructions (labels) prior to hearing the taped interviews. There were 20 *Ss* in each subgroup. The experiment was conducted in a large university classroom in two successive experimental sessions (50 *Ss*, 10 *Ss* from each subgroup being randomly assigned to one of the two sessions).

Ss were assembled and given the following instructions:

> You are about to hear two short tapes of interviews with children. Read the direction sheet carefully. It tells you how to proceed.

Each *S* read the following directions at his seat:

> You are about to hear a taped interview between a (label) boy and a student teacher. Please complete the following questionnaire as the type is played. At the end of the tape you will be given sufficient time to complete your questionnaire -- but try to go through it as rapidly as possible.

All *Ss* read the standard directions for completing the semantic differential.

Five subgroups of 10 *Ss* each were present in each session, each unaware that they were receiving different information about the child to be interviewed.

Session I presented the interview with the Negro child first. *Ss* were permitted ten minutes to complete the semantic differential scale following the end of the first taped interview.

After the completed scales had been collected, *Ss* were given another set of identical instructions containing the same reference label as the previous set. *E* said, "Now we want you to read the directions again on the new set of papers. You will notice that the directions are exactly the same as for the set you just completed. Now listen to the second interview and make your ratings." The same procedure used for the first tape was followed for the second tape.

The second session was conducted in exactly the same manner as the first except that the order of tape presentations was counterbalanced.

Results and Discussion

Table 2 summarizes the results of the analysis of variance used to assess the effects of (a) Label (b) Dialect and (c) Pupil Characteristics. The effects of Dialect significantly interacted with the Pupil Characteristics rated by the *Ss*. This interaction is represented in Figure 1. *Post hoc* analysis of simple effect revealed no significant differences between mean semantic differential ratings on the Personality scale for the two interviews. The Negro child received significantly lower mean scale scores on the Social Behavior ($p < .05$), Academic Intellectual Ability ($p < .01$) and Home Background ($p < .01$) scales.

Insert Table 2 About Here

Insert Figure 1 About Here

Comparisons between characteristic scale means based on the Negro child's tape revealed that the Personality Scale mean was significantly higher than the other three scale means ($p < .05$). The latter three means did not significantly differ from one other. There were no significant differences between mean scale scores based on the Caucasian child's tape for the four characteristics.

Figure 2 presents the mean scale scores received by the Negro and Caucasian child respectively, for each item on the semantic differential scales. For purposes of presentation, pairs have been arranged so that traits assumed to be positive appear on the extreme right while presumably negative traits are all arranged at the extreme left of the scale. As indicated in Table 2, the mean score for the Negro dialect tape was significantly lower than the mean for the standard dialect tape. Labels assigned to the interviewees had no significant effect upon semantic differential scores (see Table 2.)

It was noted earlier that the mean sentence length in the responses of the two interviewees differed. The Negro child made significantly shorter replies than the Caucasian child did to the same questions. A subsequent study was undertaken to determine the possible influence of this difference on the preceding results.

Typed transcripts of the two interviews described earlier were presented to 128 college juniors who were enrolled in Education School courses but had not participated in the previous experiment. *S*s were asked "to read the two transcripts carefully and based upon what was read, decide which was transcribed from an interview with a Negro child and which from an interview with a White child." Once they had decided on the race of the respondent, *S*s were asked to indicate briefly what characteristics of the transcripts had determined their decisions.

A total of 66 *S*s assigned the transcripts correctly, while 62 *S*s did not. The differences between the frequencies was *not* significantly different from chance expectancy ($p > .05$). There was no indication of difference in the cues used by *S*s in deciding the race of the interviewees from the transcripts. Of the 66 *S*s who were correct in their decision, only nine mentioned using linguistic cues like syntax and sentence length. Of the 62 *S*s who incorrectly assigned the transcripts, six made reference to linguistic cues. Hence, there appeared to be little evidence of an ability to identify the race of a pupil from a transcript of the pupil's verbal behavior during an interview--and no evidence that correct identifications were related to specific linguistic cues in the transcripts. It is plausible to suggest that the negative inferences made about the Negro child were most probably cued by the dialect features of the child's verbal behavior, rather than by the average length of sentence utterances. The results suggest that non-standard Negro dialect is associated with a complex of relatively less positive inferences about the characteristics of a speaker than is the standard English dialect.

Interestingly enough, the disability labels had no differential effects on evaluative inferences. Since Semmel and Dickson (1966) and others have previously demonstrated the differential effects of labeling, it may be that the linguistic cues provided by dialect are so powerful that they minimize the effects of labeling.

References

Asch, S. E. Forming impressions of personality. Journal of Abnormal and Social Psychology, 1946, 41, 258-290.

Guskin, Judith T. Negro Dialect: Effect on teacher's perception of ability and personality of students. Unpublished paper, University of Michigan, Center for Research on Language and Language Behavior, 1968.

Kelley, H. H. The warm-cold variable of first impressions of persons. Journal of Personality, 1950, 18, 431-439.

Lambert, W. E. A social psychology of bilingualism. Journal of Social Issues, 1967, 23, 91-109.

Semmel, M. I., & Dickson, S. Connotative reactions of college students to disability labels. Exceptional Children, 1966, 32, 431-439.

Table 1

Sequential Order of Questions Asked During Structured Interview

SCHOOL

What grade are you in school?
What kind of teacher do you have?
How does she help the children in your class?
What are your favorite subjects and why would you choose them?
If you were having quiet time in school, what sorts of things would you do with the other children in your class?
What do you think a teacher should do if she catches a child cheating on an arithmetic test?
If you saw the child cheating, what would you do?
What would you do if you had an arithmetic problem and you were having difficulty doing it?
If your class was having an election for class president and your name was suggested , what sorts of thing/would you tell the class you could do for them?

HOME

Tell me about your family
If you were pouring yourself a glass of milk after school and the glass slipped and broke, what would your parents say or do? What if your sister or brother did it?
Who is the boss in your family?
What jobs do you think children should do around the house? What should the parents do with the children if the jobs aren't done?

SELF

What do you like best about yourself?
What do you like least about yourself?
If you could be anyone in the world you wanted to be, who would you look and act like?

Table 2

Summary of ANOVA

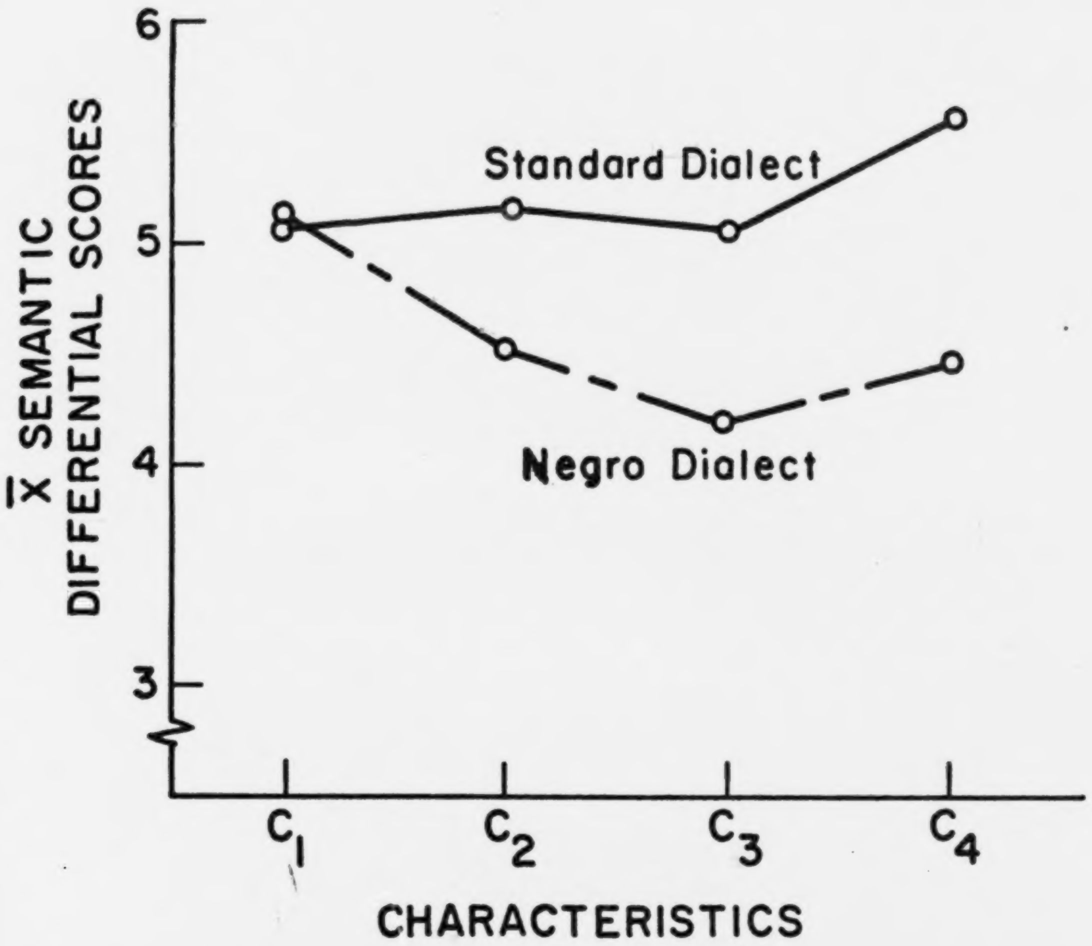
Variation	SS	df	MS	F
Between Ss	247.7964	99	———	
(Labelling grps) A.	20.1623	4	5.0400	2.103
Ss w/groups	227.6341	95	2.3960	
[error (a)]				
Within Ss	414.8437	700		
(Dialect) B	80.8292	1	80.8292	65.027**
AB	3.2393	4	.8090	.650
B x Ss w/grps.	118.0996	95	1.2430	
[error (b)]				
(Characteristics) C	26.7243	3	8.908	30.506**
AC	6.7928	12	.566	1.938
C x Ss w/grps.	83.4286	285	.292	
[error (c)]				
BC	35.8284	3	11.943	60.318**
ABC	3.3624	12	.280	1.414
BC x Ss w/grps.	56.5391	285	.198	
[error (bc)]				

** Sig. at .01 level

Figure Captions

Fig. 1. Mean semantic differential scores by characteristics for standard and non-standard dialects.

Fig. 2. Semantic differential ratings of standard and non-standard dialect groups on four variables.



C_1 = Personality

C_2 = Social behavior

C_3 = Academic, intellectual ability & school adjustment

C_4 = Home background

Figure 1

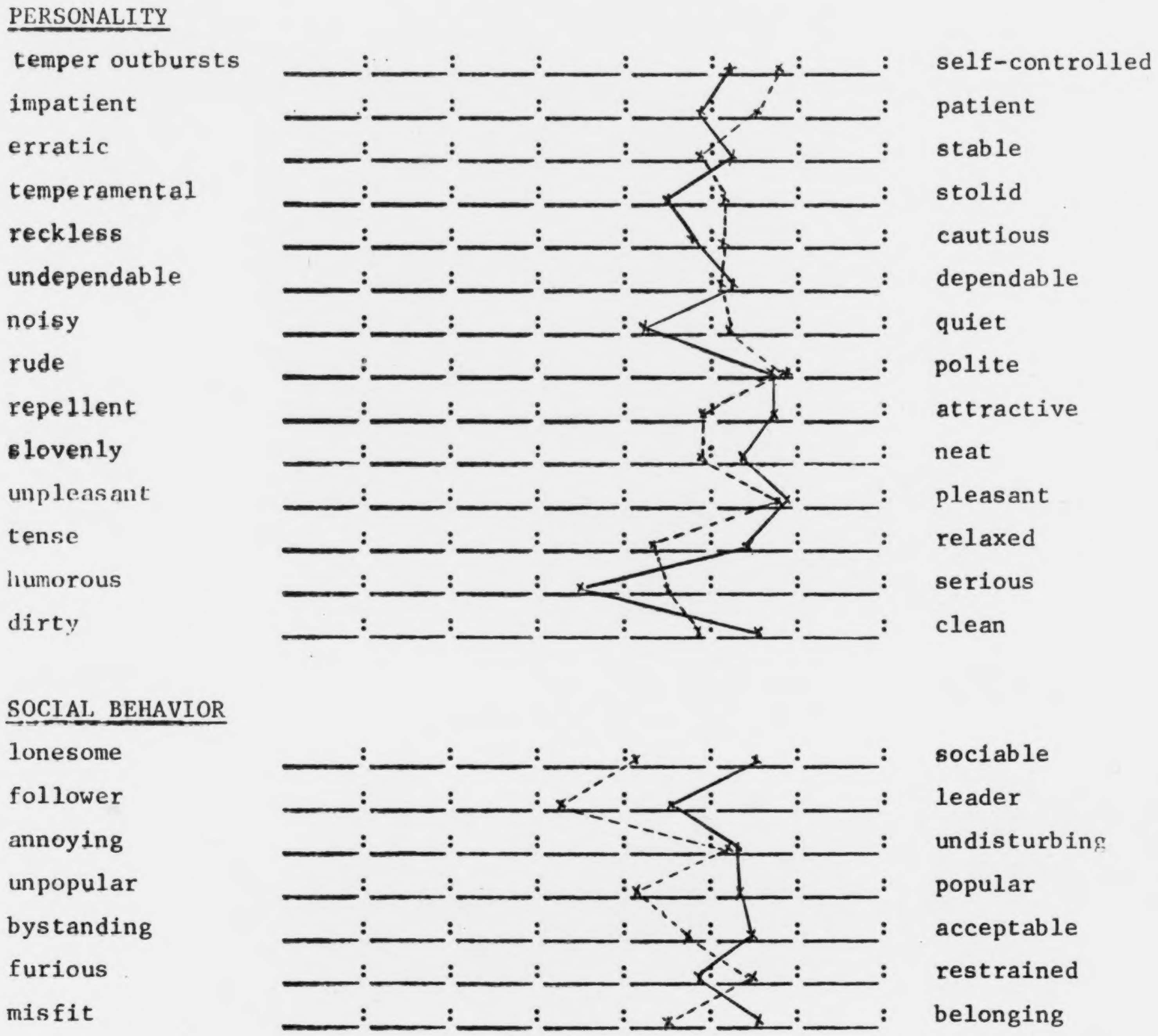


Figure 2

----=Non-Standard (Negro) Dialect

____ =Standard (Caucasian) Dialect

Semmel, Figure 2 - continued